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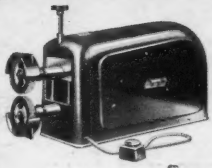

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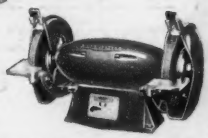

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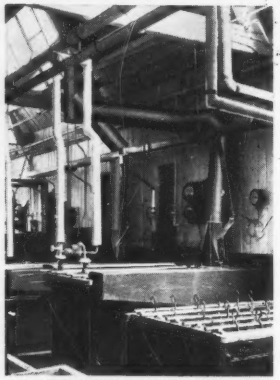

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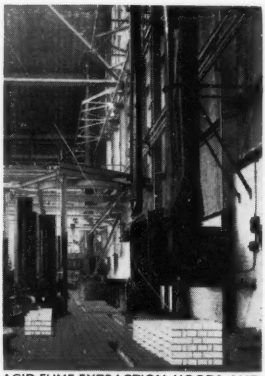

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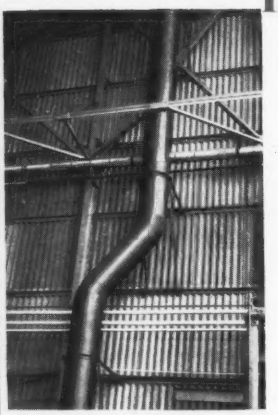

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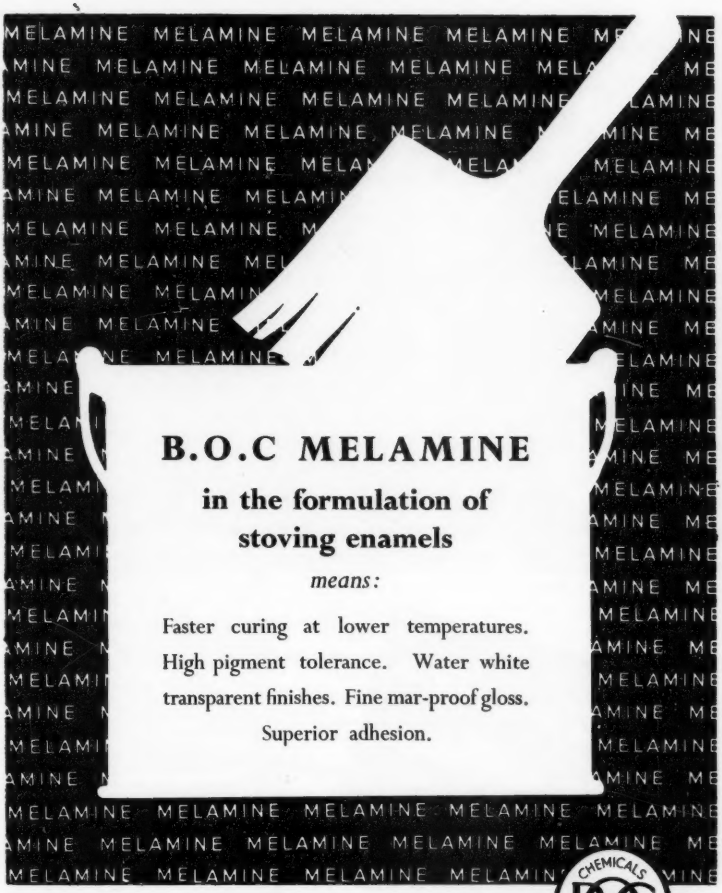


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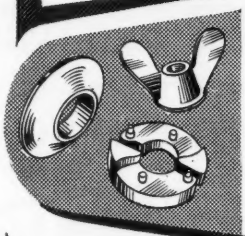

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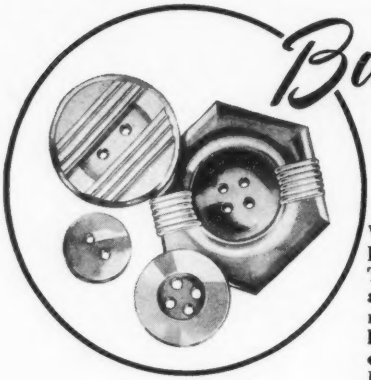

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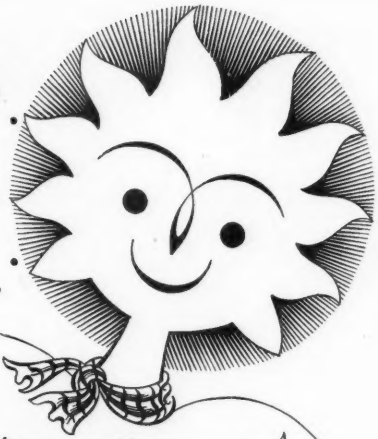

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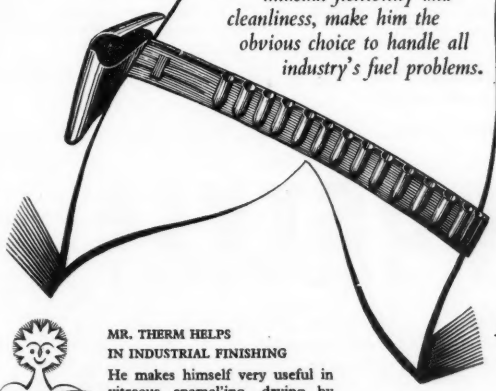

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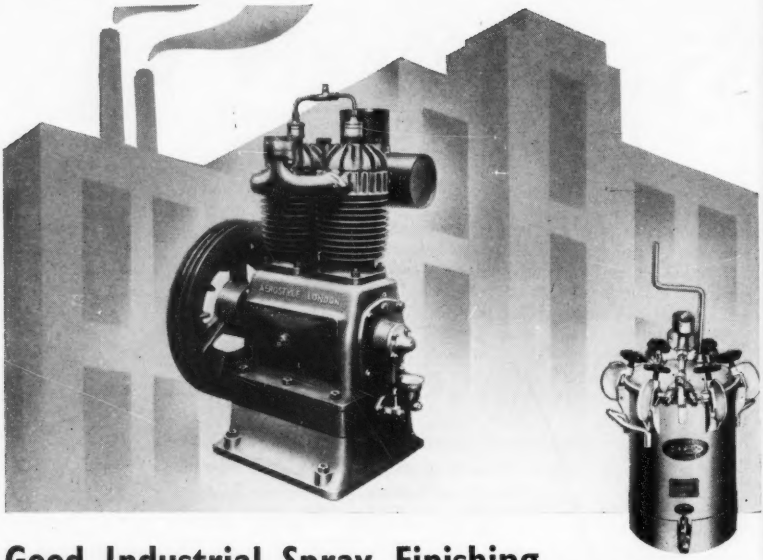

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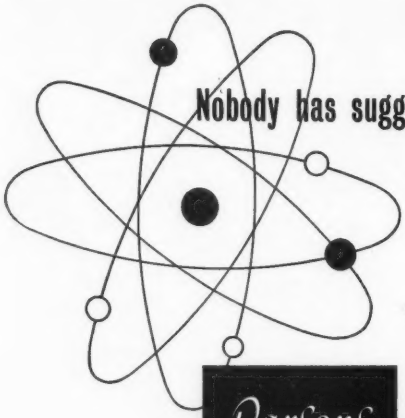

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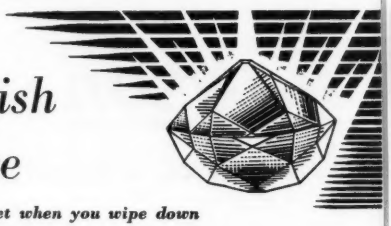

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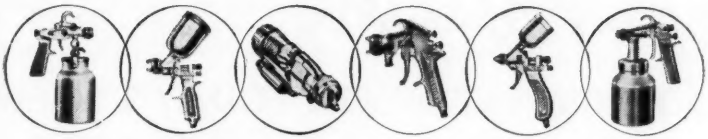

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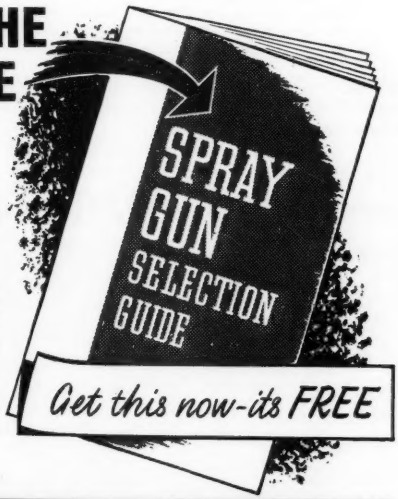


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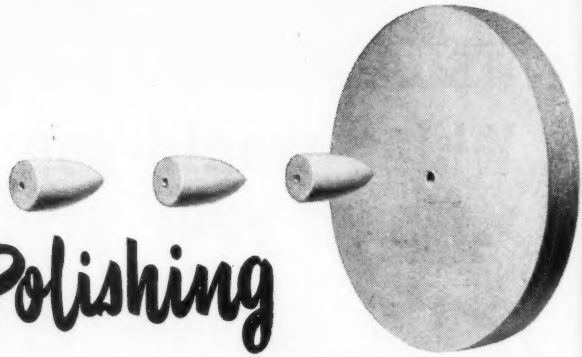

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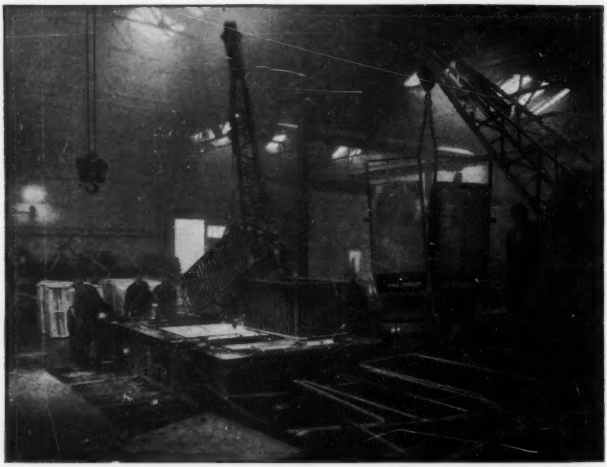

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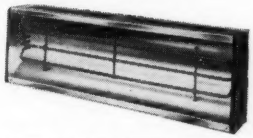

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# INDUSTRIAL FINISHING

(Incorporating "CORROSION")

## AUGUST 1953

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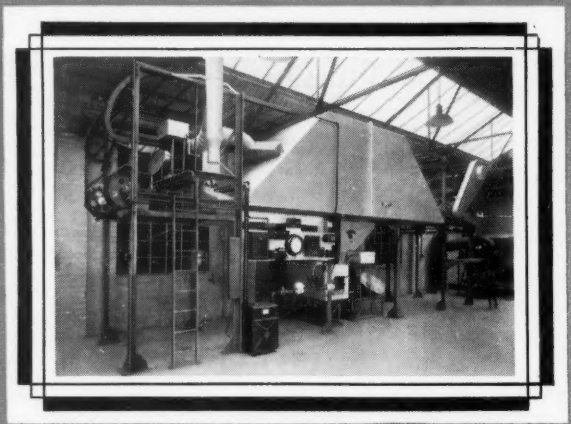

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# PROGRESS

ONE of the most familiar sights of the British sea coast is the rust-streaked hull of the average steamship. Almost inseparable from every picture of the sea-going ship back in port is the sight of the 'bosun's chair hanging over the side, the men with the chipping hammers, the wire brushes and the patchwork of red oxide paint. It is part of the ritual of ships and shipping!

Rust removal and phosphating to prepare surfaces for paint has become accepted as quite normal practice in almost every type of steel-using industry it has invaded the world of motor-cars, perambulators, cycles and toys, it has even been applied to external steelwork on buildings but, so far, it has not touched the shipping industry. It has been the subject of discussions among shipowners and shipbuilders but the conservative shipping industry has been slow to respond.

True, experiments have been conducted, there was one in Falmouth about eighteen months ago; one in Holland about a year ago; another in Hamburg where a complete hull is being pretreated, but, in general, they are still experiments. A few weeks ago, however, an event occurred which may mean a lot to the British shipping industry. A complete ship was rust-proofed and phosphated prior to painting. She was launched on the Clyde and has been completely sealed inside and outside by a proprietary process. After treatment she was painted with a well-known brand of marine paint and is now in the fitting-out bay at a Scottish yard. The full story appears elsewhere in this issue.

This is the first ship in the world to break with tradition and the chipping and scaling hammer, it is the first ship in the world to use a modern pretreatment, and it is, if successful, going to save a lot of money in repainting and maintenance during its lifetime. If this ship is satisfactory, an immense new field is going to open up for the pretreatment of ships in the construction stages. We shall have to wait six months to see. If, when that ship comes in for her first check-up, the old rust streaks are missing and paint is still adhering, we have really made progress.

The important thing about it is that Britain has again been first in the field. Rust-proofing and phosphate treatments are by no means new. America rust-proofed her motor-cars as far back as 1935, but it had to be left to this country, and particularly to the Clyde, to launch the first rust-proof ship!

# HOT SPRAY PAINTING

**AN INDUSTRIAL FINISHING FACTUAL REPORT**

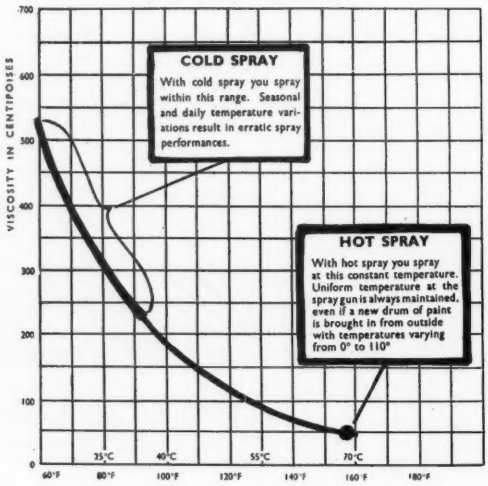
THE last three years have seen a considerable and growing interest among paint users in the possibilities of the hot spray process. It has long been acknowledged that there are tremendous advantages in the principle of spraying paints and lacquers at higher temperatures, but not until recent years has the right equipment been available.

It is true that a few years before the war hot lacquers were talked about by many, tried by a few, and generally discarded. Most of these tests were prematurely conducted, with insufficient technical developments to back them up. In certain countries, however, hot spraying has been very successfully developed. In Sweden, for example, 90 per cent. of all lacquers are now sprayed hot and in Holland about 50 per cent. Although the theoretical value of the process has long been recognised in this country, its general acceptance and adoption has been delayed because there was no practical, trouble-free and economically-priced device to accomplish heating. Unfortunately the paint manufacturers also found that it was not always a simple matter to adjust every formula for hot spray.

During recent years, however, efficient and reasonably-priced equipments have been placed on the market and certain progressive paint manufacturers have developed formulations suited to the process so that the hot spraying of paints and lacquers is now a commercial possibility and is being carried out by literally hundreds of users all over the country.

Even so, many prospective users, listening to the tales of their associates who have had unfortunate experiences in the early days are misled as to the present-day position. Moreover, some of the less progressive paint manufacturers' representatives, having no suitable formulations nor the experience to discuss the project in an intelligent manner, tend to condemn the process and discourage the prospective user by giving him a lot of misleading facts and figures to prove that their particular type of

**FIG. 1. REDUCTION IN VISCOSITY**



cold spray material is superior.

On the other hand, some of the more enthusiastic exponents of the process will sell a plant to a user in circumstances which are definitely not suited to hot spraying technique, with the result that there is yet another disappointed user who immediately tells his acquaintances what a "flop" it was in his plant. In fact, to quote one prominent manufacturer of hot spray equipment: "There has been almost as much 'hot air' talked about the subject as there has been 'hot lacquer' sprayed."

The object of this article, as with all of the "Factual Feature" series, is to lay before the reader the facts for and against to make comparisons and to provide the reader with the necessary information to enable him to decide if the process can be of value to him.

Let us start at the beginning. What is hot spraying? Nothing more, in theory, than the use of heat to reduce viscosity instead of solvents. A glance at Fig. 1 will show the principle of the process. In most cases the paints are heated to a fairly high temperature, between 160° F. and 200° F., just prior to spraying. By substituting heat for thinners, a whole series of benefits are obtained. Labour and materials are saved, production is increased and a higher quality finish can be achieved.

The actual methods used for raising the temperature vary with the individual plants and are described and illustrated on pages 24, 26 and 27, whichever method or equipment is employed, certain basic principles are involved. The hot spraying technique offers a number of advantages to the user and has comparatively few disadvantages. The principal advantages are summarised under the following headings:

*Savings.*

1. On paint
2. On solvents
3. On labour
4. On rejects
5. On air
6. On fuel costs for baking.

*Better Quality.*

1. Provides a smoother film with less orange peel
2. Provides greater gloss
3. Surface imperfections are covered better
4. No blushing when spraying cellulose lacquer

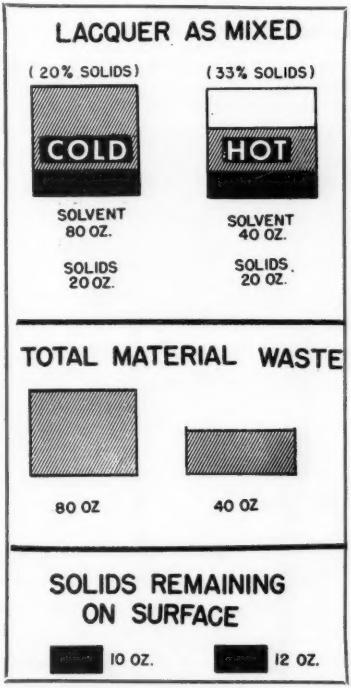
*Better Health*

1. Less solvent fume to inhale
2. Less spray fog to rebound into sprayer's face.

This may seem quite an imposing list but each item can be justified and in many cases several of the savings and advantages can be achieved in one plant. Taking them one by one we get:

1. *Saving on Paint*

To many users this will no doubt be an important point but, nevertheless,




**The difference between the two types of spraying is shown diagrammatically in this illustration. As all solvent is eventually lost it counts as waste. More solvent goes in overspray with cold application, therefore less solids remain on the surface after drying out**

## DATA ON THERMO-SPRAY PLANT

**This unit uses an air heater providing controlled temperatures up to 200° F. It employs an insulated hose and is, in effect, a simple heat exchanger. It has the advantage of having no moving parts.**

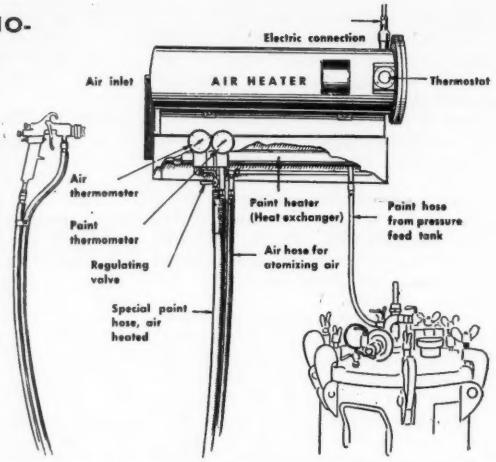
*Heat transfer medium:* **hot air.**

*Method of circulating paint:* **none, outside pressure vessel used to feed paint to spray-gun.**

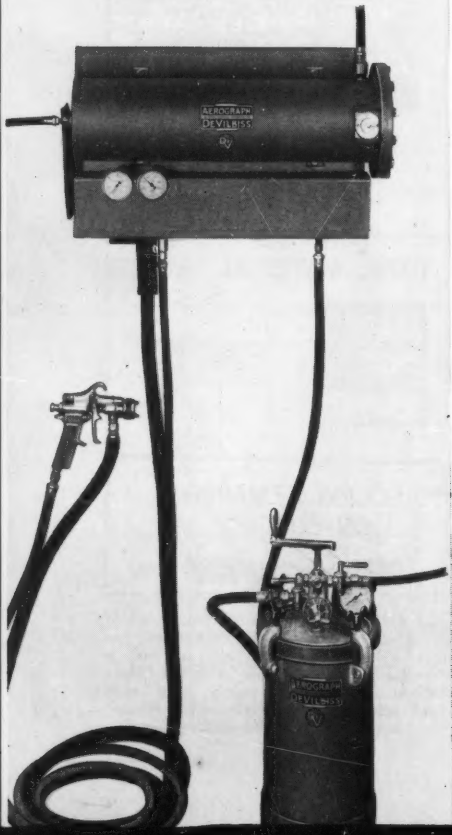
*Paint-heating coil:* **enclosed in air-heating chamber.**

*Floor space occupied:* **none, unit hangs on wall.**

*Working temperature:* **up to 300° F.**




**Paint circuit and internal construction details of the Therm-O-Spray paint heating unit**




it requires the most careful attention. In general, paint savings can be accomplished because heated paint requires less air for atomisation, therefore, proportionately fewer paint particles are blown past the article being sprayed.

Frequently 50 per cent. of the paint is lost in cold spraying with the general standard of operator only too frequently employed today and even under ideal conditions it is estimated that at least 25 per cent. of the paint is lost in this way.

Experience has shown that material applied by the hot process goes much farther; it covers more square feet per gallon and gives a better-looking job into the bargain. Typical savings reported are the following: a furniture finisher is now getting 400 sq. ft. per gal. where, formerly, he got 330 sq. ft. A refrigerator finishing line is now doing a two-coat job with better coverage where, formerly, six coats were used.

In this connection a number of tests were undertaken some time ago by the Hercules Powder Co. of America. A report was published and we understand that this is still available from the Hercules Co. Table "A" is taken from that report and reproduced with acknowledgments. It shows the trend

of paint consumption and coverage in hot and cold lacquer respectively.

2. *Saving of Solvents*

Because heat is used to reduce the viscosity, considerably less solvent is required. Where maximum build with one application is required it will sometimes be found that no solvent is needed to be added to the material as supplied by the manufacturers. Tests have shown that on an analysis of hot spraying of lacquer the direct material costs are nearly 15 per cent lower than with cold spray.

When a typical 30 per cent. solids hot lacquer is used, 2·33 lb. of volatile solvent are required to apply 1 lb. of lacquer solids. When the same lacquer is applied at 21 per cent. solids at room temperature, 3·76 lb. of solvent are required to apply 1 lb. of lacquer solids.

3. *Saving of Labour*

As heated paint is far simpler to atomise, a spray gun becomes a far more efficient tool and can handle a far greater volume of paint per period of trigger action than when the material is cold. This results in fewer strokes of the spray gun being necessary to give adequate coverage to a given surface area; in many cases criss-crossing of strokes is eliminated and where a sprayer may take ten strokes to spray a given area he will only require six or seven if the material is being applied hot.

Apart from the direct labour saving mentioned above, there are additional indirect savings in that there are far fewer rejects to be dealt with, there is a smaller total of sanding or rubbing down time between coats in view of the cutting down of the number of coats themselves.

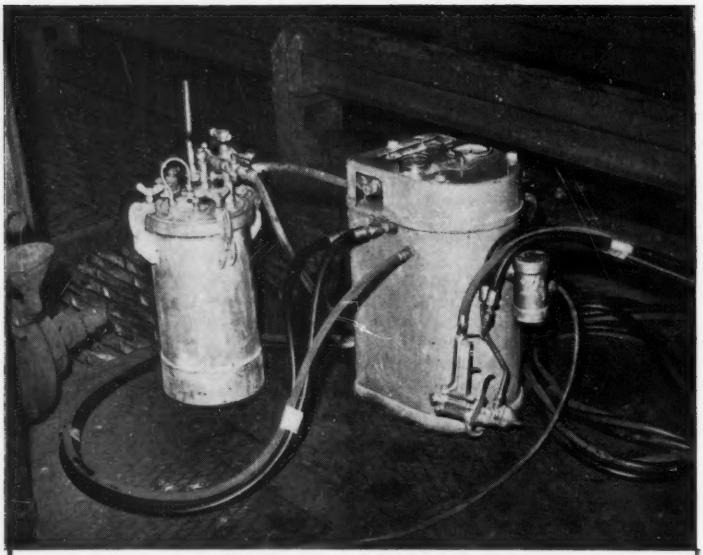
4. *Fewer Rejects*

By using the hot spray method the number of rejects which are caused by improper spraying, poor covering or sags can be very greatly reduced. We heard of one large refrigerator manufacturer who reported that rejects from these causes were reduced by as much as 90 per cent. when he installed his hot lacquer plant. Sags especially are cut down as it is a common tendency for all good sprayers to spray a wet film which nearly approaches the sagging point. In the hot spray process there is a much greater margin of safety.

HOT-SPRAY AND COLD-SPRAY LACQUERS—COVERAGE AND COST COMPARISONS
(A typical cold-spray lacquer, Number 1, was used as comparison basis, 100.)

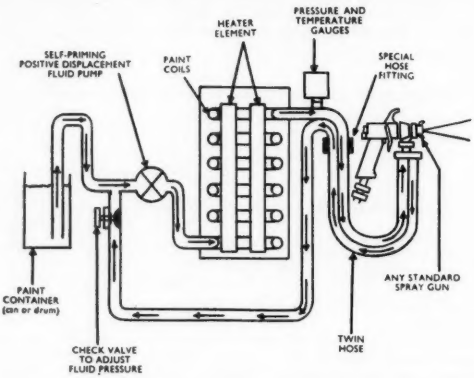
| *Lacquer factors compared* | *Standard cold-spray solvent* | | *High solvency solvent lacquer* | *Hot-spray solvent* | |
|---|---|---|---|---|---|
| | *Lacquer No.* 1 | *Lacquer No.* 2 | | *Lacquer No.* 1 | *Lacquer No.* 2 |
| Lacquer solids, per cent ... ... | 20 | 20 | 26 | 31 | 31 |
| Lacquer coverage, area per gal.—films 2 mils thick ... ... | 100·0 | 101·6 | 133·9 | 163·7 | 161·3 |
| Lacquer cost per sq. ft.—films 2 mils thick ... ... ... ... | 100·0 | 111·9 | 95·5 | 88·3 | 86·6 |
| Lacquer cost per gal. ... ... | 100·0 | 113·7 | 127·6 | 144·4 | 139·7 |
| Lacquer, pounds per gal. ... ... | 100·0 | 101·1 | 102·2 | 105·1 | 103·2 |
| Lacquer, cost per pound of solids | 100·0 | 112·1 | 95·5 | 88·2 | 86·8 |
| Solvent cost per pound of lacquer solids ... ... ... ... | 100·0 | 125·7 | 90·3 | 75·8 | 71·7 |
| Solvent cost per gal. of solvent ... | 100·0 | 130·8 | 130·6 | 143·1 | 129·2 |
| Solvent cost per pound of solvent | 100·0 | 127·8 | 130·1 | 140·3 | 131·7 |
| Solvent cost per pound of lacquer | 100·0 | 127·2 | 120·4 | 123·8 | 114·9 |
| Solids in lacquer, per cent. by weight ... ... ... ... | 100·0 | 100·0 | 130·0 | 155·0 | 155·0 |
| Solids pounds per gal. of lacquer | 100·0 | 101·2 | 133·8 | 163·6 | 161·0 |
| Solids cost per pound of solids ... | 100·0 | 100·0 | 100·0 | 100·0 | 100·0 |
| Solids cost per gal. of lacquer ... | 100·0 | 101·8 | 133·7 | 163·6 | 161·0 |

*Taken from "Report on a Study of the Hot Spray Application of Lacquer" by Hercules Powder Corporation with acknowledgments*



**Above: Bede plant in use on production line**

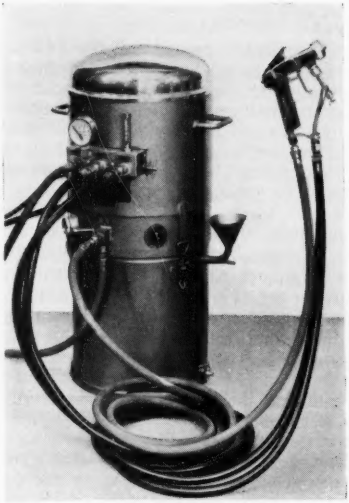
**Paint circuit and internal construction details of the Bede hot spray unit**




## DATA ON BEDE PLANT

This unit is a pump-circulated type and has a flow and return hose to the spray-gun.

*Heat transfer medium:* cast aluminium block.
*Method of circulating paint:* air motor-driven pump.
*Paint-heating coil:* steel tube cast in aluminium.
*Floor space occupied:* less than 2 sq. ft.
*Working temperature:* 160-180° F.



## DATA ON ECCO PLANT

Another pump-circulated type, but operating on a different principle of heat transfer. It consists of three sections; a pump section, a heater section and a water section.

*Heat transfer medium:* hot water.

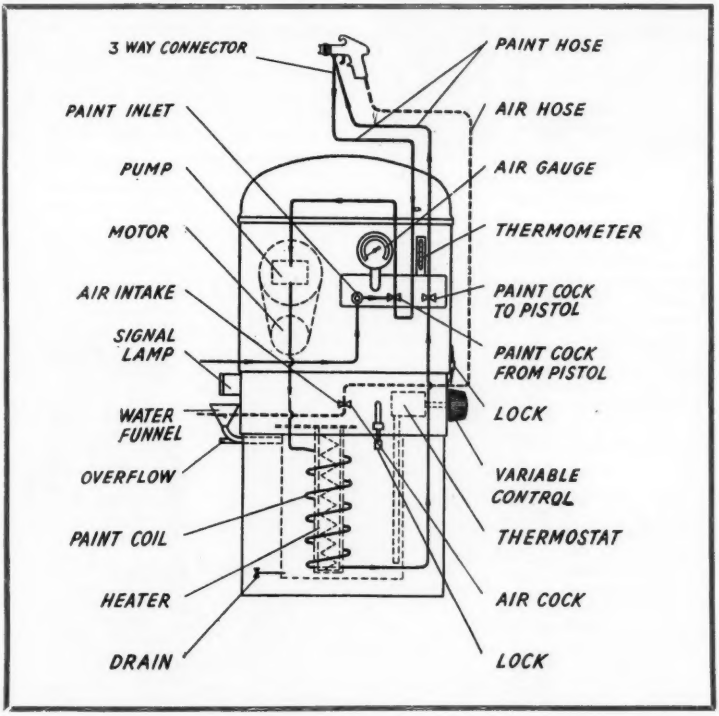
*Method of circulating paint:* electric motor-driven pump.

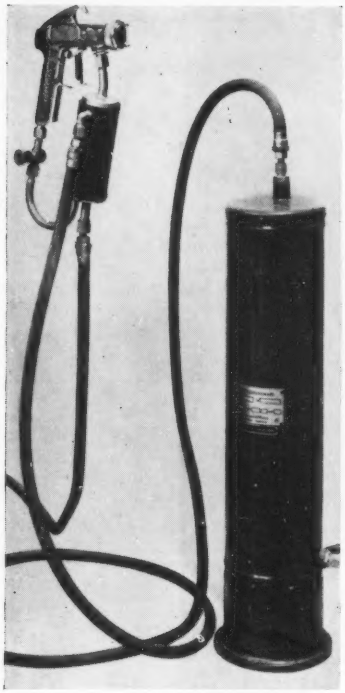
*Paint-heating coil:* immersed in water in the lower chamber.

*Floor space occupied:* less than 2 sq. ft.

*Working temperature:* up to boiling point of water.

**LEFT: Atlas Diesel Co.'s Ecco hot lacquer unit**





5. *Consumption of Air*

As already mentioned, the amount of air required for atomisation of hot lacquer or paint can be reduced by nearly half and similarly the rate of operation of the spray booth exhaust system can also be reduced. obviously, over a year, the saving here can be very appreciable.

6. *Saving of Fuel in Baking*

In view of the fact that the quantity of thinners deposited on the surface of the job is considerably reduced, the stoving schedule can similarly be reduced and, in fact, where radiant heat ovens are used, in many cases the "flash off" period can be dispensed with and the articles put straight into the radiant heat tunnel.

These factors, of course, save time and also fuel in the actual operation of the oven itself where a tight production schedule is involved, and conveyor space is limited.

*Improvement in quality*

It is also possible to obtain several improvements in quality. Due to the material being applied at a high temperature it is easier to ensure a proper flow and as a result one obviates the many cases where a job is spoilt by

*Above: Paint preheater for use in outside work in cold weather. Whilst not an actual hot spray unit it uses the same principles*

o

*Right: Atlas, model KV3, cup heater for use in garages, etc., to give advantages of hot spray method when only small amounts are needed*

"orange peel" and a smoother, less porous film is obtained.

The eradication of "orange peel" automatically results in an improvement in gloss and furthermore, because of the high solids content of the material, the surface imperfections tend to be covered as there is little shrinkage of the film through the evaporation of large quantities of solvent. In fact, owing to the smaller solvent content of a good hot spray formulation, more solids are actually deposited on the work than with the normal system, resulting in a denser coat and better "filling" properties. (See diagram on this page.)

One definite advantage of the hot spray process is the ability of the user to eliminate "blushing." This phenomenon occurs when the temperature of the material is lowered to a point below that of the surrounding air, thus inducing condensation. Evaporation of the solvents, plus expansion of the compressed air causes a refrigerating action. Because of the high temperatures involved, the atomised particles in hot spray drop much more in temperature than the same particles in cold spray, but still reach the product surface at a higher temperature and with better flow characteristics than in cold spray.

Some finishers mistakenly anticipate that the paint will strike the surface in a very warm state, and are disappointed in the hot spray process when they find out that this is not so. It is important to bear in mind that the atomisation takes place within 1 in. of the tip of the spray gun where the opposing air streams from the cap converge. The rest of the fan action simply spreads the atomised particles to the desired pattern for easy spreading of the paint on the surface. The subsequent paint chilling can be ignored.

*Disadvantages*

As stated earlier, there are comparatively few disadvantages to the hot spray process, rather should they be classed as *limitations*. They are, briefly, as follows:

1. Higher cost of materials
2. Longer drying time required
3. Operator fatigue
4. Need for an adequate volume of the right type of work.

**Diagram to show the comparative powers of hot- and cold-sprayed films to cover surface blemishes. The hot film has a higher solids content and, therefore, leaves a much thicker dried film**

None of these is in itself serious enough to deter a prospective user of the process but we shall deal with them in order to make the position quite clear.

*Cost*

The price of a gallon of hot spray material is often higher than that of room-temperature material because some of the thinners are omitted and a larger proportion of solids which are higher-priced ingredients is present. In spite of the slightly greater cost per gallon of hot spray material, it is very economical to use.

The savings in materials and in the cost of application which can be obtained more than offset the small price premium. In furniture, the average hot lacquer is about 20 to 25 per cent. higher in cost per gallon, but 40 to 55 per cent. greater coverage can be obtained.

It is not proposed in this article to go into the differences in formulations between a hot or cold spraying material, let it be said and fully understood however, that whereas a material formulated for hot spray can quite frequently be sprayed cold, it is not true to say that a material normally formulated for cold spray can always or even generally be sprayed hot, as is very often the claim of those who know no better.

*Drying Time*

One of the advantages of the process is that it enables a heavy coat to be applied in one operation. As the rate of drying is in inverse proportion to the thickness of the coat, it follows that films built up in one thick application *can* take longer to dry in certain cases.

This applies mainly in the case of wood finishes which require burnish-

(*please turn to page* 44.)

# New Paintshop Layout at Marconi Factory

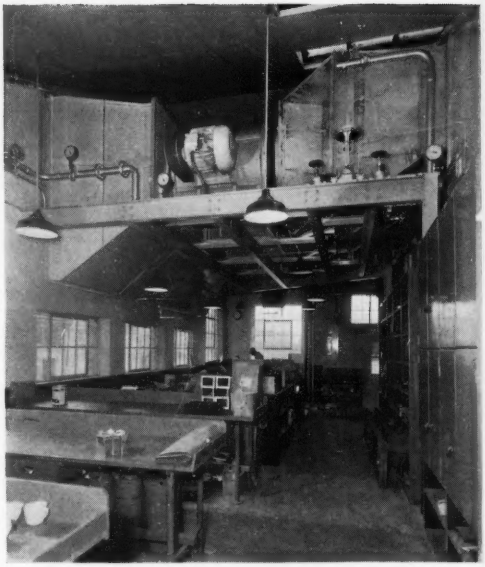


Fig. 1. Steam-heated unit for supplying conditioned air at 80,000 cu. ft. per min. to the spraybooth area

MODERN marine, military and industrial radio and electronic equipment, as distinct from the orthodox domestic radio receivers and television sets, makes use of considerable quantities of stoved paint finished metalwork. This is found in the form of sheet metal panels, angle and box sections, framing, perforated grilles, trays, cabinets, chassis pressings, screens, shelves, etc.

This metalwork is pretreated and finished in a variety of shades and surface textures according to the final purpose of the part, its destination or duty. When it is realised that the colours range through several shades of grey to green, white and black, and the surface finishes also vary to include wrinkle, gloss, eggshell matt and clear varnish or insulating lacquer, the difficulty of producing this variety of finishes under production line conditions becomes apparent. It calls for a paintshop layout of unusual flexibility and versatility.

In order to cope with the requirements outlined above, Marconi's Wireless Telegraph Co. Ltd., have recently installed a new mechanised paintshop at their Chelmsford factory. This paintshop, which we recently had the privilege of visiting is a most impressive place. It is approximately 130 ft. long and contains over 75 ft. of water-washed spraybooths, a complete air filtration and extraction plant and a gas-fired air circulating oven of special design. Further equipment includes a water recovery and filter pit and set of pumps and marine type interceptors for the water circulating system. In addition to the paintshop the layout includes a pretreatment section with I.C.I. degreasers, a Granodising plant and a 22 ft. long water-washed spraybooth for metal spraying.

This latter, designed and installed by Spray Finishing Systems, is provided with its own filter pit and pumphouse as distinct from those of the paint spraybooths. In addition to the equipment described, there is a compressor room, shotblasting and rumbling equipment, and the whole installation, when complete, should

prove to be one of the most modern metal finishing plants in this country.

The complete paintshop was designed by T.C. Spray Finishing Systems in co-operation with Marconi's Engineering Section. The general layout can be followed from the diagram on this page. As will be seen, the layout is planned to allow work to flow through from the jigging and loading area at the left of the plan in the enclosed plenum area in which the spraybooths are situated. The work is loaded on to the Teleflex conveyor at this point and is subsequently carried through the spraybooths, oven and cooling section by the conveyor. From the conveyor the work is unloaded to the inspection benches seen at the top right of the plan.

The conveyor enters the spraybooth area at a point between the first two banks of booths so that work which has to have several coats with a flatting operation between each coat can be taken off the conveyor as it passes, flatted and reloaded with the minimum of handling. To facilitate this rubbing down and flatting operation the layout includes a pair of special flatting tables with tanks and circulating water flow over the surface. These are to be seen in the plan and on some of the photographs. Several special hanging fixtures have been designed in the form of yokes to carry a predetermined number of components suspended from swivel hooks on the conveyor.

The loaded conveyor passes down through the spraybooth area to serve the individual booths and terminates at the oven, from here, it returns outside the plenum enclosure to the jigging and loading point again.

The plenum unit which supplies conditioned air to the spraybooth section is noteworthy. It filters, heats and circulates 80,000 c. ft. of air per min. and is capable of raising the temperature of the air supplied to a maximum

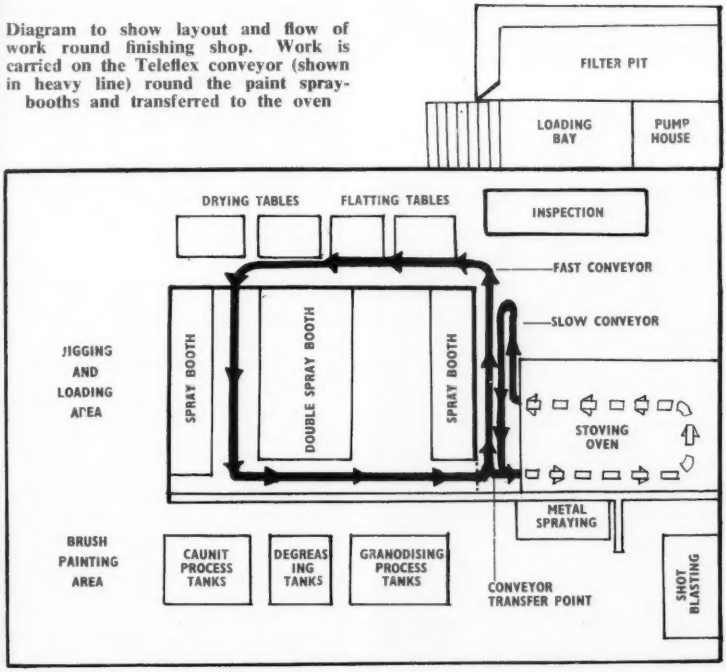



**Diagram to show layout and flow of work round finishing shop. Work is carried on the Teleflex conveyor (shown in heavy line) round the paint spraybooths and transferred to the oven**

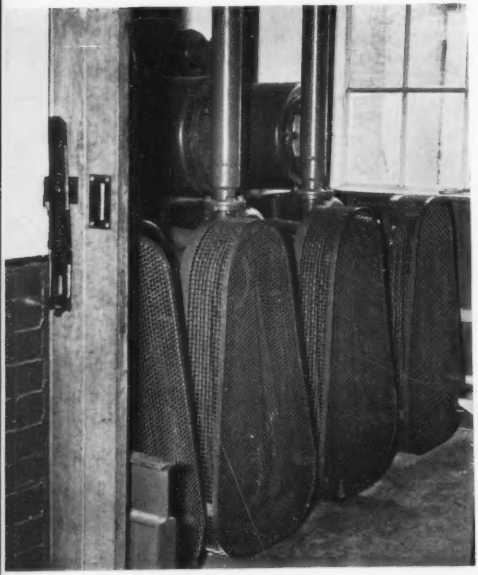


**Fig. 2. Girdlestone pumps and marine-type oil interceptors in the pumphouse. These are used to clean and circulate the water to the booths**

**Fig. 3. Outside filter pit showing weir over which water flows on its way to the filter boxes**

of 35° F. above ambient (taking ambient as 65° F.). It is steam heated and is situated up in the roof above the jigging and loading section as shown in the photograph (Fig. 1). This unit is rated at 3,200,000 B.Th.U.'s per hour, consuming about 3,720 lb. of steam per hour at a pressure of 45 lb., sq. in. at the heater units. The air flow is maintained by a set of three Airscrew two-stage axial flow fans of 48 in. diameter. Control is by Bristols pneumatic controller of the non-indicating type. This may be seen at the top right side of the photograph.

Extraction from the spraybooths is at the rate of 70,000 c. ft. per min, thus ensuring an overspill of clean air and maintaining clean, comfortable working conditions. The air conditions inside the booth area are such that the wearing of special masks is unnecessary.

Inside the plenum area the spraybooths are arranged to suit the particular requirements of the work handled. At the intake end of the enclosure (left in the diagram) is a 22 ft. 6 in. long water-washed booth divided into four sections.

Next comes a back-to-back double sided booth 17 ft. 6 in. long. Between this and the 22 ft. 6 in. booth runs the Teleflex conveyor which feeds the work from the booths to the oven. At the extreme right is another single sided water-washed booth about 17 ft. 6 in. long. Each section of spraybooth is well fitted out being provided with its own lighting fixtures, air line, pressure reducing valves, etc., most of the sections are also provided with turntables for handling bulky work. All the booths are of standard S.F.S. water washed type, supplied by Spray Finishing Systems.

The water from the backs of the water-washed booths is taken, by underground conduits, to a central filter pit where it is passed over a weir and into a large settling tank. From here it is pumped up via filter sections and Girdlestone marine-type oil interceptors (Fig. 2) to return to the spraybooths. A separate pumphouse is situated just outside the paintshop above the filter pit (see Fig. 3), and this is equipped with a battery of four Girdlestone pumps supplying water to

the booths via the marine interceptors mentioned before.

The oven employed on this installation is of the gas heated, air recirculating type and was built by Richard Skelton Ltd., to the design of the installation engineers. It is 40 ft. long and 13 ft. wide. Rated at 550,000 B.Th.U.'s per hour with gas of a calorific value of 50,000 B.Th.U.'s per cu. ft. at normal supply pressure.

The interesting point about it is that it is built in the form of a U in order to conserve space. In order to take full advantage of the potential capacity of the oven it is necessary to work out some method of ensuring that it would always be full of work regardless of the rate of flow of work from the spraybooths. This has been achieved by a very ingenious arrangement of fast and slow conveyors with a transfer mechanism.

The conveyor from the spraybooths carries work on hangers at 10 ft. spacing at a speed of 10 ft. per min. The hangers are mechanically transferred at the entrance to the oven to another conveyor running at a speed of 2 ft. per min. with hangers spaced at 2 ft. intervals. The two conveyors are synchronised and the work flows steadily from the booths and is packed closely in the oven with the minimum of waste space and, consequently, the smallest degree of oven temperature variation. The entrance to the oven and the transfer point of the conveyor system can be seen in the photographs (Figs. 4 and 5).

The oven is operated at a temperature range from 250° F. to 325° F. according to the requirements of the work. The air recirculating fan has an output of 16,000 c. ft. per min. and maintains this at about 1·5 water gauge. The entrance and exit of the oven are provided with air seals in order to prevent heat losses, these are operated by centrifugal fans which can be seen immediately above the conveyor entrance in the photograph.

The work which the oven and conveyor system is called upon to handle varies from small sheet metal assemblies to large sheet panels and various sizes of castings. The efficiency with which the installation handles this mixed load reflects great credit on

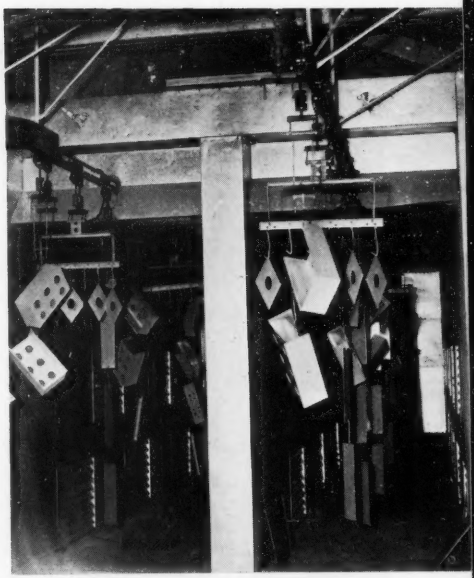


**Fig. 4. Conveyor entering and leaving the gas-fired air recirculating oven. This conveyor has carriers at 2 ft. spacing**

**Fig 5. Changeover point on the conveyor system, the fast conveyor transfers its load to the slow conveyor to enter the oven**

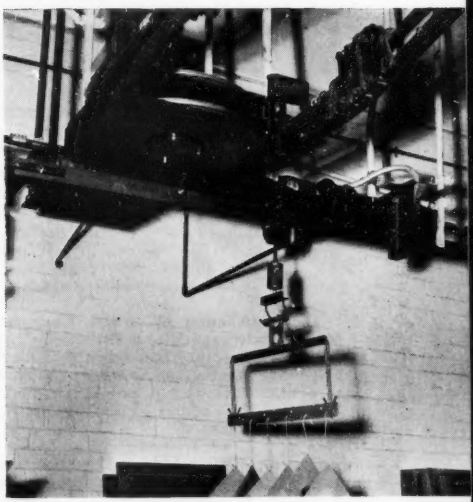


Fig. 6. Looking down the shop from the inspection benches, on the right are the flatting and treatment benches; in the centre enclosed plenum area and, at the left, the entrance to the oven enclosure

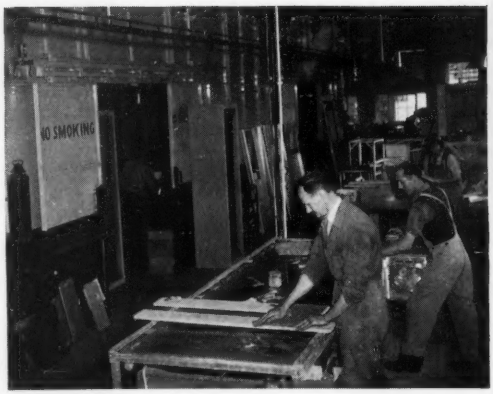



Fig. 7. Two of the water-washed flatting tables. The water is fed from a tank under the bench and is pumped up to flow over the working surface

Spray Finishing Systems, the designers.

Some of the components passing through the paintshop are used in the Chelmsford Works and are delivered to other parts of the factory. Other components are packed and despatched to other factories and outside destinations. In order to facilitate this despatch it has been found convenient to arrange a loading bay for vehicles between the filter pit and the pump-house at the top right of the plan. This permits direct loading of finished parts on vehicles with the minimum of risk due to exposure to weather in transit.

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**The Association of British Chemical Manufacturers** and The British Colour Makers' Association announce that their Telephone number has now been changed to HYDe Park 4126/6 and HYDe Park 1557/8. The address, 166 Piccadilly, remains unchanged.

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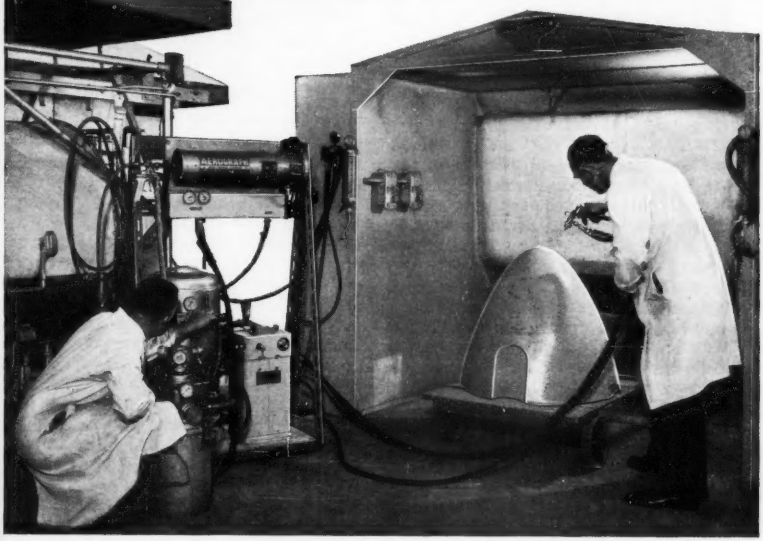
**Ceramic Platers Ltd.,** is the title of a new Subsidiary recently formed by Montgomery Plating Co. Ltd. The new company, operating from 443 Coleshill Road, Coventry, are operating a specialised process under licence from United Chromium Ltd., of America. This process, known as "Crystcolor" is patterned plate effect showing iridescent colours by means of light diffraction. It is understood that the effect is obtained by the deposition of layers of metal oxide.

# HOT SPRAY PAINTING



## *How to Control the Finish—from the Start*

The great advantages of Hot Spray painting are only just being realised. For many industrial purposes the use of the pre-heating process will give an excellent finish much more quickly, with less labour and with an appreciable saving in cost.

For those who want to know more about it, the Demonstration Centre offers full facilities for practical demonstrations on customers' own products. What is more, we will gladly train paint-shop operatives at specially arranged short intensive courses—at no cost or obligation to the customer.

This is *your* opportunity to gain impartial and unbiased advice on the process that is revolutionising many industrial finishing procedures. If the process is suitable for *your* product, we will show you how best to use it. If it is *not* suitable we will save you expensive "trial and error".

The photograph shows a corner of the Demonstration Centre with operators hot-spraying synthetic enamels at the water-washed spray-booth. Three types of paint heaters are shown in the illustration. Take advantage of this "know-how" and let us help you to *control* your finish.

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# American Finishing Developments

A DIGEST OF THE ARTICLES DEALING WITH FINISHING PROCESSES, WHICH HAVE BEEN PUBLISHED IN U.S.A. TECHNICAL JOURNALS.

**Ion Exchange System for Chromate Recovery is Economical, Efficient**

The need for the prevention of stream pollution and the critical need for chromic acid has caused American industry to consider a variety of disposal methods. There is a demand for equipment to recover chromium-containing ions from baths employed for anodising aluminium, chromium plating, and copper stripping, in which processes chromic acid becomes contaminated with metallic cations.

One ion exchange method which is reported to be producing successful results in eliminating stream pollution and returning usable chromate to the treatment tank, utilises synthetic resins. The system incorporates a cation exchanger to remove metallic cations from the strong chromic acid anodising solution and an anion exchanger to recover chromate from dilute rinse solutions. Hydrogen ions are exchanged for metallic ions. The cycle is completed by using ion exchange resins for recovery of chromium ions.

The anodising bath is operated at a *p*H between 0·7 and 0·9 and 50 to 70 grms. per litre of chromic acid. A portion of the bath is withdrawn each day and passed through the bed of a high-capacity cation exchanger. Aluminium and other metallic cations are removed from this portion and hydrogen cations are substituted. The resulting solution, having a very low *p*H, is returned and mixed with the remainder of the chrome bath, lowering the overall metallic content and *p*H.

When the resin becomes exhausted, it is regenerated by contact with sulphuric acid. The effluent sulphuric acid, along with the metallic cations, is sent to waste. This acid is then washed from the unit with water. The chromic acid is displaced with water, and this results in some desirable dilution.

A tank for the purpose of saving the rinse will conserve from 60 to 90 per cent. of the chromate being dragged from the treatment tank. However, the remaining chromate still requires treatment, and is therefore sent through the bed of an anion exchanger, which removes chromate ions and substitutes hydroxyl ions. When treating virtually pure chromic acid, this results in the formation of water in place of acid. Because the equipment also operates as a water demineraliser, the rinse tank contains demineralised water almost exclusively. Thus, when chromic acid is removed, demineralised water remains that can be returned to the rinse tank for re-use.

It is reported that, compared with conventional disposal methods, this system costs 50 per cent. less for initial instalment, operation costs are 75 per cent. less, about 80 per cent. less floor space is required, water and steam consumption is 85 per cent. less, better plating and anodising is obtained, and higher quality finish products are produced.

(*Industry and Power, November,* 1952.)

**Abrasive Cleaning Line for Stainless Steel Gives Higher Lustre at Lower Cost.**

To mass produce stainless steel with extremely high lustre, the scouring machines employed by Pittsburgh Crucible Steel Co., Pittsburgh, Pennsylvania, unwind rolls of fresh abrasive paper and coils of metal simultaneously into pressure rollers. Although continuous pressure-scouring by this method does not eliminate further annealing, pickling and tempering, it is said to present the best possible

surface for these treatments. The abrasive surface presented to the metal is always fresh and clean. The scouring area and pressure are uniform, although it is possible to adjust the pressure to suit any particular surface conditions. Experience has shown that the method is cheaper and more uniform than either finish grinding or chemical cleaning, and is more suitable for mass production. The machines remove less surface metal and cause less variation than conventional finish grinding. In ten years of practical plant use, the system has been used for the removal of all kinds of surface defects, and also to salvage finished steel of less than perfect lustre.

The complete metal-scouring line consists of a collapsing and expanding feed reel; pinch rolls that feed the steel strip through guides; a hold-down roll; three scouring machines; a kerosene scrubbing unit; and a paper feed and rewind reel. To condition both sides of the metal, each scouring machine has a set of feed rolls and a set of pressure rolls at the top, and identical sets at the bottom. The top pressure roll at each location is adjustable and has a lightening guide that "snubs" the paper.

### "Furane" Plastic Cement Protects Chemical Processing Equipment

A plastic, known as "Furane Cement," which is produced by Atlas Mineral Products Co., Mertztown, Pennsylvania, appears to be of special interest to chemical processors because it provides a protective seal for the types of acid-proof brick and tile that line or cover chemical vessels, stacks and floors; and because it can be cast or moulded into corrosion-resistant tanks, ducts, fittings, and pipe.

The cement material is an infusible plastic based on a mixture of a liquid polymer or furfuryl alcohol or furfural and a finely divided inert filler, such as carbon, silica or acid-washed asbestos. The liquid resin consists of either a polymer of furfuryl alcohol or a copolymer of furfuryl alcohol with furfural or formaldehyde, plus free furfuryl alcohol or furfural. The powder form contains a chemically inert filler and a small amount of acid catalyst, such as paratoluene sulphonic acid, sodium acid sulphate, or paratoluene sulfonyl chloride. The powder and liquid are supplied in separate containers for mixing on the job. Carbon-filled furane cements are claimed to have excellent resistance to all non-oxidising acids, alkalis, salts and most organic solvents. They are less dense than the silica and asbestos-filled compositions, which are subject to attack by hydrofluoric acid and its salts.

When furane liquid resin is mixed with approximately twice its weight of the inert filler, the acid in the filler acts as a catalyst at ordinary temperatures and polymerises the furane cement mortar. Using a trowel, it is easy to apply the mortar to seal the joints of a floor made of brick, tile or grouted masonry. Generally, working time varies inversely with temperature. When the cement is used as the raw material for cast or moulded shapes, ordinary metalworking machinery can be used to saw, grind, turn, drill or tap. Furane cement mortar can be used to join moulded pieces together, if their surfaces are clean.

(*Chemical Engineering Progress, December,* 1952.)

### Ethoxyline Resins Produce Coloured Glaze for Concrete Blocks

Workers in the paint factory of Sherwin - Williams Co., Cleveland, Ohio, are using the new class of ethoxyline resins to produce an economical non-ceramic coloured glaze for concrete. Although it is reported to cost 40 per cent. less than comparable ceramic glazes for concrete building blocks, this organic glaze, known as "Kem-Krete," also enhances their appearance and improves their resistance to heat, acids, alkalis and flame. The resin combination is based on the Epons of Shell Chemical Co., New York. A somewhat similar application is the NuPon "A" finish (Glidden Co., Cleveland, Ohio) which is also based on Epon.

In the Sherwin-Williams process, after the dry blocks come from the blockmaking machine they are sanded smooth (by-passing this step results in a textured-finish block), then passed under a device which applies a colour-

less epoxy-resin filler. This filler is "squeegeed" into the block pores. Immediately afterwards, the final tinted coat is sprayed on. For the spraying process, the ethoxyline resin (polyaryl ethylene oxide—one of the condensation products of epichlorohydrin and bisphenols) is stored in one tank, and an amino-curing catalyst such as ethylene diamine is stored in another container. They are united at the spray nozzle in constant predetermined proportions, a special nozzle being employed. After the blocks have been sprayed, they are placed on pallets and cured for 16 hours at room temperature.

The coat as applied is almost 100 per cent. solids. On the finished block, the coat is about 16 or 17 mils. thick. Because the coating is organic rather than ceramic, it can readily be painted if desired.

It is anticipated that this possibility of producing a permanent glazed coating in any colour will give another outlet not only to the manufacturer of synthetic resins, but also to the manufacturer of concrete building blocks. At present, the process is only feasible to the large manufacturer of blocks, who can afford the installation of the new unit required; however, there seems to be a strong possibility that enterprising rivals will develop a system whereby the coating can be mixed at the job site.

(*Chemical Week*, 10*th January*, 1953.)

### Pre-printed Adhesive Tape Saves Drawing Repetitive Symbols in Plant Layouts

Planning departments of many large industrial plants in the U.S. report large reductions in drawing office time, by using pressure-sensitive tape pre-printed with plant layout symbols. Use of the tape saves tedious drawing of repetitive symbols and makes changes both easier and neater. The tape can be stripped off repeatedly without leaving marks or losing its adhesive quality.

All standard symbols for walls, aisles, conveyors, monorails, centrelines, columns, shafts, stairways, service lines, railway tracks, sidings and coloured arrows for material and process flow, are available in either 324-space or 5481 in. rolls (or both) scale $\frac{1}{4}$ in. to 1 ft., in opaque and transparent type, opaque tape is used for photo copying, the transparent type being employed for reproduction on standard ammonia vapour machines. Tapes are of white or coloured acetate of high tensile strength and excellent printing quality. They are wrapped in foil and packed in separate boxes. Adhesive, and all other qualities, are retained almost indefinitely whether the tape is stored or applied to layout sheets. The kit includes a specially designed cutting knife.

(*Tooling and Production, December*, 1952.)

### Reinforced Plastics Reduce Cost of Storage Tanks, Increase Corrosion Resistance

To fabricate corrosion-resistant tanks simply and economically, many American manufacturers now utilise reinforced plastics instead of more conventional materials such as metal, rubber, acid-proof brick, and wood. The lightweight plastic tanks, made of polyester resins and fibrous glass, are strong and stable even when exposed to extremes of weather. They solve many general and special problems related to the storage of oil, fuel, chemicals, plating, pickling, etc.

A typical example is produced by Murdock Tank and Manufacturing Co., Tulsa, Oklahoma, who manufacture reinforced plastic oil storage tanks known as the equal-segment type. It is possible to ship the segments economically and assemble them on site.

The cylindrical bottom of each tank, like the top, is assembled from ten pie-shaped sheets, each having a wall thickness of 0·125 in. and extra thickness (0·165 in.) at the bolt line. Layers of glass mat, each $\frac{3}{16}$ in. thick, comprise the section. A series of layers is impregnated with white-pigmented polyester resin and then moulded in a tilting-head hydraulic press. Each section has two corrugations. Bolt heads are moulded into the assembly channels. The extra thickness at the bolt line and strips of reinforced plastic to cover all metal surfaces, eliminate the need for other inside support despite the bolt holes; and they also prevent

the corrosion of bolts and loosening of joints, which can occur in steel tanks in cold weather. Operators trim the flash from each moulded section and punch the bolt holes as soon as the section is removed from the press.

The sides of each tank are comprised of ten curved rectangular sheets, each 5 ft. wide and 8 ft. high, of the same wall thickness as the bottom, and fabricated in the same manner except that the moulding press has a curved interior that fits the rectangular sheets. The ten bottom sections, ten curved side sections, and ten top sections, whose integral colour cannot flake, are assembled to build a 250-barrel tank that is about 15 ft. in dia., and 8 ft. high. Doubling the height of the tank by adding a second ring of side sections doubles its capacity; and tripling its height with a third ring increases its capacity to 750 barrels.

(*Modern Plastics, February,* 1953.)

### Flame-retarding Additives Create New Uses for Thermoplastics

To expand the usefulness of thermoplastic materials—polyethylene, polystyrene, and cellulose acetate butyrate plastic, and also natural and synthetic rubber, Diamond Alkali Co., Cleveland, Ohio, has developed an additive mixture that makes them self-extinguishing in case of fire. The essential ingredients of the "fireproofing" mixture are Chlorowax 70, a chlorinated paraffin wax containing 70 per cent. chlorine by weight, which has been used for flameproofing textiles, and antimony trioxide, which is commonly called antimony oxide. It also contains various plasticisers, pigments, and extenders that are incorporated in ordinary plastic compounds; and a substance that helps the compounds to withstand processing and use at high temperatures without deteriorating.

The flame-retarding additives become homogeneous with any of various plastic compounds during conventional milling equipment commonly used for processing. The addition of suitable stabilisers and lubricants, and special care during mixing and moulding, help to keep the temperature below 425° F. and to prevent decomposition of the chlorinated paraffin.

Treated polyethylene plastics are reported to have excellent electrical properties, which remain constant even after long immersion in water and long exposure to high temperatures. The additives have little effect on the beneficial mechanical properties. Processing can be effected either by injection moulding or by extrusion. Because they can be extruded on wire at high speeds, these plastics are especially useful as flame-retarding dielectric materials for coating cables and conductors in neon signs and television equipment.

Flame-retarding polystyrenes are stated to be uniform in composition and easy to mould. In mechanical properties they are somewhat less shock-resistant and more subject to distortion from great heat than untreated polystyrene. However, they can add a desirable safety factor to such products as toys or wall tile.

Treated cellulose acetate butyrate retains all the desirable properties of butyrates.

(*Modern Plastics, January,* 1953.)

### Improved Centreless Grinding Process Uses an Abrasive Belt

An improved centreless grinding process—using an abrasive belt instead of a wheel—gives promise of fast grinding and rough finishing of bar and tube stock in competition with conventional centreless grinding. One pound of metal per minute can be ground off stainless steel and high alloy tubing by the process, according to reports. The machine has been developed by Behr-Manning Corporation, Troy, New York, to combat finish and taper problems encountered in Ugine-Sejournet extrusion — a French process that uses molten glass as lubricant.

The first machine will be employed for removing taper (up to 0·020 in. per 15 ft. length) in extruded tube, and for grinding off die marks and traces of the molten glass used in the extrusion process.

Cylindrical stock in sizes from 1 in. to 6 in. can be accommodated, and finishes down to 16 micro-in. are obtained with fine grit belts. Stock removal rate holds good for all sizes of stock by adjusting the feed through

the grinding belt speed and stock rotation. Tolerances can be held to ±0·001 in., according to the manufacturers. Holding the fast-moving belt against the work under heavy pressure is a 375 lb. steel contact wheel (20 in. diam. by 9 in. wide), which serves also as a drive pulley. The machine, V-belt driven by a 25 h.p. motor, has operated at speeds of 3,500 to 8,500 surface ft. per min.

The workpiece feed rate, variable from zero to 30 ft. per min., is obtained through variable speed drive and regulator belt assembly adjustable for work feed angle of from zero to 15 deg. Used instead of the conventional rubber-boned regulator wheel, this assembly features a waterproof cloth feed belt coated with 220 grit aluminium oxide. The belt, measuring 9¾ in. wide by 58 in. long, is backed by a rigid flat steel platen, to provide uniform pressure across the face of the belt and to maintain dimensional accuracy.

The grinding belt is coated with 50 grit aluminium oxide, and measures 168 in. long by 9 in. wide. Cutting oil is fed to the belt through a recirculating system and manifold nozzle. Extra width on the in-feed side of the regulator belt starts the workpiece rotating before it contacts the grinding belt. The work-rest is offset towards the grinding belt side, to maintain and control pressure between the workpiece and regulator belt, and the work feed angle can be changed at any time.

(*Steel*, 8th December, 1952.)

**Special and Standardised Power Brushing Assemblies Help Production**

Power brushing, applied to special production jobs or through a newer approach that calls for standardised set-ups, offers opportunities for time and material saving.

A problem presented to brushing experts at Osborn Manufacturing Co., Cleveland, Ohio, required removal of rubber flash and film from six bearing and electric ground sections of tank track after moulding. Removal was necessary to ensure good electrical contact for static elimination. Osborn designed a special machine, constructed to remove excess rubber from all six areas simultaneously in a few seconds. Six 0·014 in. wire brushes are mounted and spaced so that all the operator has to do is to feed the track pin into position. The pin is rotated in a direction opposing the rotation of the brushes, then dropped out of position automatically as the next pin is fed into the machine.

No further work is necessary to expose the metal for perfect electrical contact, the operation is speeded up considerably, and much material formerly wasted is now salvaged.

For some time, this firm has offered a brushing set-up that cleans conveyors continuously without shutdowns or cleaning by hand. However, a formidable restriction in many plants was adequate experience or equipment to build adequate brush-driving and necessary supporting equipment. To remedy this, the company has now designed a standard assembly that carries out the complete job, ensuring proper operation of the brush. The cleaner comprises a special 12 in. diam. brush mounted in a suitable bearing and coupled to a geared motor. The latter is built on a channel base with an opening under the brush, so that material cleaned from the conveyor can be carried away for salvage. Special guards guide the brushed-off material into the channels. The motor drive can be coupled into the belt drive so that brush and belt stop simultaneously. The user has only to fasten the unit in place, with proper adjustment, and then connect to a power source.

(*Steel*, 24th November, 1952.)

**Resin-Impregnated Fibrous Glass Makes Sturdy Translucent Hurricane Panels**

Resin-impregnated fibrous glass makes decorative translucent window panels that are strong enough to withstand 135-mile gales, according to tests at the University of Miami, Miami, Florida. Unlike ordinary hurricane shutters made of wood or steel, the panels are easy to install, admit light, and have a permanent decorative colour. They are as compact as they are sturdy. Because of the special properties of the fabricating material, they are waterproof, and they are reported to resist rot, rust and infestation by termites and rats or other vermin at any temperature or in any climate.

A reinforced fibrous glass panel 4 ft. wide, 8 ft. long, and $\frac{1}{6}$ in. thick, weighs only 16 lb. This is much lighter than aluminium and, according to the manufacturer (Russell Reinforced Plastics Corporation, Long Island, New York) is stronger than a steel panel of equal size and weight. When these panels are closed in case of hurricane, they do not plunge the room into darkness, and their moulded-in colours—of which five are now in standard production—never need repainting. The panels are compact, without the usual type of frame or protruding hardware, so that it is possible to stack forty or more in a space no deeper than that required for one bridge table.

Repco fasteners, which affix the panels over standard types of steel and aluminium casement windows, are small fasteners for permanent mounting on the sash frame. Their position on the frame corresponds to holes in the panels. There are no loose parts to misplace, and it is possible to install the panels without tools.

Three different thicknesses of panel were installed at the university over standard types of casement windows, and were exposed to winds and gusts up to 135 m.p.h. Coconuts, roof shingles, roofing tile, and other objects, and water equal to one month's average rainfall in Miami, were introduced into the air stream. Where the panels were hit most severely, their surfaces —even the thinnest—showed only slight abrasion.

(*Modern Plastics*, February, 1953.)

## COURSES ON SPRAY PAINTING AND DECORATING

A ONE-YEAR course on Painting and Decorating for Paint Salesmen will be held at the L.C.C. Brixton School of Building, Ferndale Road, Brixton, London, S.W.4, on Fridays from 1.30 to 4.30 p.m., commencing on 25th September, 1953. The fee will be 25s.

The aim of the course is to provide a practical background knowledge of the basic principles of the painting and decorating craft and of the characteristics and maintenance of the tools and materials in general use. The classes are intended for students engaged in the paint manufacturing trade principally as salesmen.

Shorter courses on Colour and Design for Painters and Decorators, Painting and Decorating, and Spray Painting for Painters and Decorators will also be held at the school.

Further information can be obtained from the Secretary, L.C.C. Brixton School of Building, Ferndale Road, Brixton, London, S.W.4.

## HEAT TREATMENT OF ALUMINIUM ALLOYS

AN excellent booklet on this subject, running to fifty-six pages, has been published by the Northern Aluminium Co. Ltd., Banbury, Oxfordshire.

It deals in a simple and straightforward manner with the theory of heat treatment, and then with the practical approach to heat treatment. In general considerations it deals with the temperature range, overheating, solution heat treatment periods, the effect of prolonged or repeated solution heat treatments, and high temperature blistering.

In so far as furnaces are concerned, air furnaces and salt baths are considered and the important comparisons between the two are drawn. Quenching methods are dealt with, including cold water, hot water or oil immersion, spray quenching and air blast quenching, as well as washing and drying.

## PORCELAIN IS NOW SPRAYED ON STEEL

SEAPORCELS METALS, INC., is using a hand-sized spray gun to apply porcelain material through acetylene torch, fusing it to steel, says a report of the United States Official Information Service in London. It goes on:

The company says that, although other guns have been used to spray metallised coatings, this one is the first to spray a ceramic material.

The porcelain is sprayed on to the steel to form a protective coating against corrosion. Normally such fusing is done at factories in high-pressure furnaces.

The great advantage of the new method, according to the company, is that the gun is portable, which means it can be used to coat areas that otherwise could not be treated.

At the beginning of the process, the gun sends out a flame to heat the surface of the steel. Once the right temperature is reached, the porcelain mixture is blown through tiny holes in the narrow nozzle of the gun. As the material passes through the flame, it melts and is fused to the steel plate.

# Determining Orientation of Metal Crystals with Polarised Light

KNOWLEDGE of the orientation of crystals of metals is often of practical importance to the plater and the engineer; but no generally satisfactory method has been available for determining the orientation of the small crystals found in commercial metals. Because of the need for such a method, the National Bureau of Standards in the U.S.A. is investigating the possibility of estimating crystal orientation from measurements of changes in the characteristics of polarised light. The work is being conducted by H. C. Vacher of the Bureau's mechanical metallurgy laboratory. Results so far indicate that, in the case of the industrially important alloy of 70 nickel and 30 copper (Monel), crystal orientation can be correlated with extinctions of polarised light.

Commercial metals are composed of aggregates of small crystals or grains. The magnitude of many important properties—such as strength, elasticity, and magnetism—differs in different directions in these small crystals. In some specimens of some metals the orientations of the individual crystals do not follow a random distribution; instead, a "preferred orientation" predominates, and the over-all properties of the metal vary with direction. Also, the orientations of adjacent crystals influence their interactions when the aggregate is subjected to strain, heat, or corrosive environment.

*X*-ray diffraction methods of determining crystal orientation have been attempted, but cannot be applied conveniently to small crystals. The metallurgical microscope is convenient for observing small crystals, but its use is generally limited to showing differences in orientation qualitatively. In recent years, these microscopes have been equipped so that the specimen can be illuminated with plane-polarised light. When a metallo-

**Fig. 1. Photomicrographs (×50) of 70 nickel-30 copper alloy (Monel) made with polarised light in a recent investigation. Top and bottom photomicrographs were made after the first and second polishing treaments respectively. The close similarity of the shadings of the individual crystals indicates that the apparent optical anisotropy is reproducible. The study shows that the orientation of Monel crystals can be correlated with extinctions of polarised light**

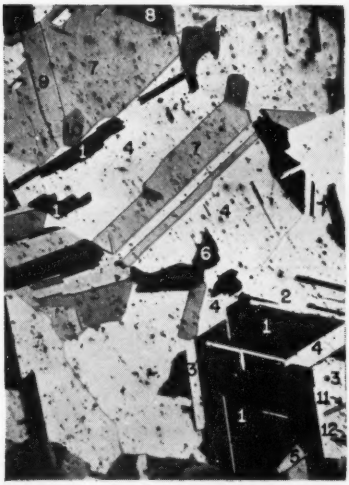
graphically polished and optically active surface is examined with such an arrangement, characteristics of reflected polarised light change measurably from crystal to crystal.

In the commercial metallographic microscope used for the N.B.S. study, the analyser is fixed in the crossed position with respect to the polariser, and the light irradiates the polished surface of the specimen at normal incidence. Under these conditions, when an optically anisotropic surface is rotated 360 degrees around the axis of the incident beam, four minima (extinctions) and four maxima will alternately appear in the intensity of the reflected light.

Although metals having a cubic crystal structure are not inherently optically anisotropic, the surfaces of many such metals—including Monel—become optically anisotropic after etching with conventional metallographic reagents. The angular positions of the polarised-light extinctions of Monel differ for adjacent crystals, and it was found that these positions remained the same after repolishing and re-etching. It seemed to follow that the apparent optical anisotropy, being thus independent of the etching treatment, could probably be correlated with crystal orientation.

Examination of annealed Monel specimens showed clusters of crystals in which each crystal was adjacent to at least one annealing twin. (A twin relationship is indicated in a polished and etched surface when two crystals are separated by a straight line.) It was also observed that some of the clusters contained a crystal whose straight-line boundaries were in four different directions. This made it possible to determine the orientation of that crystal from geometry and a knowledge of the angular relationships of the twinning planes and the co-ordinate axes of the crystal. In the Monel crystal, the twinning planes and co-ordinate axes are the four octahedral planes and the three cubic axes respectively. After determination of the orientation of one crystal it was possible to determine the orientations of the twinned crystals. The orientations of twelve crystals were determined and their extinction positions measured.

Polarised light reflected from




**Photomicrograph (×50) of 70 nickel-30 copper alloy showing twelve crystals whose orientations can be determined from the angles between their twin boundaries. Twin boundaries are straight lines and are traces of octahedral planes. The boundaries 1-2, 1-3, 1-4, and 1-5 are the traces of the four octahedral planes in crystal 1**

polished and etched surfaces that were parallel to a cubic plane or an octahedral plane change but little in intensity with rotation of the specimen. Surfaces of other orientations, however, gave extinctions whose positions could be measured with a fair degree of accuracy. Results showed that one of the four extinctions was near the cubic pole which was inclined to the surface at the smallest angle.

The N.B.S. study also indicates that the optical anisotropy exhibited by Monel is caused by parallel furrows in the surface and not, as has sometimes been suggested, by a film. The furrows are apparently formed by the tendency of the etching reagent to produce etch pits whose facets are parallel to cubic planes.

NOTE: *For further details of the N.B.S. study, see "A Correlation of Polarised Light Extinctions with Orientation in 70 Nickel-30 Copper Alloy," by H. C. Vacher, J. Research N.B.S.* **49**, 149 *(Sept., 1952), reprinted as N.B.S. Research Paper* 2351, 10 *cents, from Superintendent of Documents, Government Printing Office, Washington* 25, *D.C.*

(*Continued from page* 29)

ing or "pulling over" most stoving finishes can be treated at the same stoving speeds as cold sprayed jobs.

*Operator Fatigue*

This is only a small point but it has happened that the operator, especially when female sprayers are employed, has become tired more quickly due to the weight of the extra hose. However, modern spray-guns are light and handy and the reduction of the number of coats, in the case of hot spray, should outweigh this.

*Volume and class of work*

The hot spray plant is a quantity production tool, it is not suited to constant and frequent changes of colour as this involves cleaning out the unit, flushing with solvent and restarting. This precludes its use in the small job shop where the colours and types of material are frequently changing. On its own class of work it is, however, as fast as any other type of spray equipment.

Broadly speaking, if the volume of work is not sufficient to justify anything more than a cup-type gun, the hot spray plant would be wasted. It takes at least the same amount of work to justify its use as it takes to justify the use of a pressure container.

Another point is that the use of a hot spray plant on work such as open ironwork or tubular furniture can be very wasteful as the amount of overspray in such cases is the same as a cold spray plant but the material costs more to buy for the reasons given earlier.

*General Considerations*

There are several points which must be borne in mind when considering the merits of the system. Failure to appreciate that there is a higher solvent loss through dissipation may lead to unsatisfactory results. In other words, whilst appreciating that one of the basic factors of hot spraying is the reduced proportion of thinners required one must bear in mind that too great a reduction in the amount of thinners used will only have adverse effects.

There may be a tendency, too, to assume that by hot spraying a heavier surface film is inevitably deposited. The film thickness can be adjusted within certain limits, by varying the proportion of thinners or solvent. This is the point where the normal spray operator usually goes wrong with hot spraying. Six strokes of the hot spray will cover the same surface as ten of the cold spray, and it is difficult at first for the former cold spray operator to appreciate this point.

One of the chief causes of disappointment when inexperienced operators try to carry out the hot spray process themselves is that they do not take these fewer strokes with the gun with the natural result that the film is too thick and there are runs and sags all over the work.

*Equipment for Hot Spraying*

It is not proposed to give detailed descriptions of the various units available, basic information on them is provided in the photographs and sectional drawings on pages 24, 26 and 27. These descriptions cover the three main types of plant in general use in this country today. In the U.S.A., steam-heated plants have been developed but these have not yet reached our shores and from all accounts are likely to prove rather

## EQUIPMENT SUPPLIERS

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**Ecco unit:**
Atlas Diesel Co. Ltd.,
Beresford Avenue, Stonebridge Park, Wembley, Middlesex.

**General:**
Spray-guns and general spray equipment made by all standard suppliers can be used in conjunction with any of the above equipment. Specially formulated hot spray materials are available from most of the major paint supply houses. See advertisements in this and past issues.

too large for British purposes. We have information as we go to press about at least two new types of plant going into production. These will, of course, be described in our pages in due course.

*Conclusion*

Any paint user wishing to adopt hot spraying should obtain the full co-operation of his paint supplier in making whatever adjustments are necessary. Generally speaking, the adjustments required for synthetics are simply in the solvent addition. In the case of cellulose lacquer, it is better to have it formulated from the very beginning for hot spray. It is seldom satisfactory to take the standard material and adjust it for hot spray by juggling the solvents used. Important progress has been made recently in hot lacquer formulations which make hot spraying of cellulose lacquers a definite success. In retrospect we now realise that many of our previous attempts to accomplish hot spraying have failed because the manufacturer did not know how to make a truly good cellulose lacquer for hot spraying. In the final analysis the paint heater is simply a device to heat paint to some given temperature. The results obtained to a great extent depend upon the formulation of the finish.

## A RUST-PROOFED SHIP

EXPERIMENTS in the rust-proofing of ships' structures by Jenolizing have culminated in the launching, a few weeks ago, of a completely rust-proofed hull.

Metal pretreatment by chemical processes has been the subject of much discussion amongst ship-owners and builders; but the very conservative shipping industry is always somewhat sceptical of anything new and unproved. This cautious attitude is gradually being overcome, particularly amongst foreign owners, who have decided to spend money at least to test the process.

About eighteen months ago a section of a ship's hull was treated in Falmouth dockyard. The metal surface was chipped and wire-brushed by mechanical means, and Jenolite RRN 1 was applied with mops. This was followed by painting with Jenolite Chemical Sealer. After drying, a recognised brand of marine priming paint was applied; and finally a coat of finishing paint. Many months later, after the ship concerned had been at sea, a very encouraging report on the condition of the treated area was received from the Marine Superintendent.

Elsewhere, experiments have reached a further stage. In Glasgow, where a ship is in process of being built on the Clyde, Jenolizing and chemical sealing is being employed both inboard and outboard, from stem to stern. This is the first ship in the world to have been completely chemically sealed prior to painting and, basing assumptions on results already seen at Falmouth, it is expected that the owners of this ship will gain considerably in maintenance costs when the time comes for repainting.

An interesting sidelight on the interest aroused by the prospect of a rust-proof ship is the fact that the B.B.C. saw fit to include a 15-minute report on it in the news on the day of launching.

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# Mica in Paint Products

SPECIALLY CONTRIBUTED

MICA has become an increasingly important constituent of paint products during the past few years, and whereas there used to be a tendency to regard mica as just another filler, it is now becoming quite clear that such an attitude of mind is completely outdated. It is rare that mica is used merely as an inert adulterant; it is more often specially selected either because of the enhancement in properties it confers, or because of the defects which it is able to eliminate.

Very considerable research and development work has been conducted in the United States and Canada, on mica in paint products, and mica is a typical and popular constituent of many formulations which find their way across the Atlantic. In Great Britain and Europe great progress has also been made with the utilisation of mica.

Mica is one of the few minerals available to the paint trade which possess a laminar or plate-like form and at the same time are chemically inert. It is the simultaneous possession of these two properties which gives mica its special usefulness. It is important to note that subdivision of mica does not destroy the important laminar form; the area and thickness of the individual flakes is reduced, as required, but the essential plate-like form is maintained.

Mica is available in three forms, namely water ground, dry ground and micronised, and of these the water ground variety is the most useful and versatile. Water ground mica is subjected to an unusual grinding technique, resulting from years of experience in handling this mineral, and it is then separated into grades of different particle size by selective settling in water. Silica is removed in the process, as well as all water-soluble impurities, and clean, polished mica flakes of predetermined particle size are thus provided for the industry.

When the process of producing water ground mica is reviewed it will be appreciated that the product differs in physical characteristics and purity from the other available forms. In effect the attention which water ground mica receives compares favourably with that normally given to a manufactured pigment. Simple visual observation is all that is necessary to distinguish water ground mica from the dry ground variety.

As with most paint product raw materials one cannot generalise on the effect which will be obtained by the introduction of mica, and results may vary in special cases. Research has, however, provided useful pointers to the ways in which the unusual properties of mica can often be exploited with advantage.

Mica prevents the hard caking during storage of such pigments as red lead, white lead, zinc dust and micaceous iron oxide, and of fillers such as barytes. The effectiveness of the mica is influenced by the type of medium present, and some media yield much more satisfactory results than others. The type of resin present is important in this respect, as has been shown by results from research on media containing run natural copal, pure and modified phenolic resins, limed rosin, rosin-maleic adducts and alkyds.

The influence of mica on settling rate is often not marked, but there are many examples from the above where it does prevent the formation of a hard compact or glue-like settled pigment cake. Mica thus makes it possible to redisperse settled pigment easily by simple stirring. The uniform dispersion of the mica into the other pigments and fillers during grinding, means that when the whole of the mineral matter settles during storage it does so as a composite mass, with mica flakes separating the individual particles of other pigments and fillers from each other. They have in effect a cushioning action.

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It is not necessarily so serious that pigments in paints settle during storage, for this is a natural phenomenon, which is invariably found in some degree, but more important is the type of pigment settlement obtained, and research has indicated that mica is very likely to be of value in this respect. In fact, the evidence of its effectiveness is now so great, that it could be automatically incorporated in all cases of stubborn settlement as they arise with a fair chance of success. Calcium plumbate, now becoming popular as an alternative anti-corrosive pigment to the conventional red lead, metallic lead, etc., is very prone to settle badly to an almost indispersible condition in certain types of media, and is an obvious case for incorporation of mica.

In finishing processes where the enamel or other pigmented product is applied by dipping, settlement of pigment in the dipping tank, when this is left undisturbed overnight, or over weekends or holiday periods, may be a nuisance, if hard caking occurs. The relatively low viscosity required for dipping encourages settling, but the presence of mica has a useful modifying influence on the compactness and glue-like condition of the caked pigment, and is thus worth considering as a constituent of dipping paints.

It often happens that when coating articles by dipping that the pigmented finish flows away excessively from sharp edges and leaves the area around them either free of enamel, etc., or the coating is so thin that the metal underneath "grins through." A small percentage of mica has been found very beneficial in reducing this tendency.

It is perhaps important to emphasise at this point that for the best effect care should be taken to thoroughly disperse the mica itself in a pigmented composition, and this means fine grinding, with or without the assistance of a wetting agent. In certain media mica tends to exhibit a flocculating tendency and research has shown that this is eliminated by such wetting agents as zinc naphthenate. It is obvious that if the mica is not completely dispersed its beneficial effect will be reduced, and more will need to be incorporated for best results. In carefully balanced formulations this additional mica may be undesirable. For some effects, however, perfect dispersion of the mica is not necessary and examples of these will be mentioned later.

One important item of cost in a finishing operation involving the use of a filler which has to be flatted, is the time consumed in this operation. The flatting operation is facilitated if the pigment-extender combination of the filler is modified with a proportion of mica. Mica is of special value, too, in the relatively new emulsion or synthetic water paints which are becoming so popular. There is no doubt that mica imparts improved water resistance, and this is reflected in better scrub resistance, and better adhesion of the paint coating under humid conditions. The value of mica in this type of product is due to the fact that it possesses the two-fold function of improving adhesion and providing a barrier against free ingress of water through the coating to the undersurface.

Failure through scrubbing is usually caused by failure of adhesion of the coating to the undersurface, especially if this is of non-absorbent type. It is much rarer to find the coating gradually reduced in thickness by attrition and failing in this way; more often is the adhesion of the coating to the undersurface impaired by penetration of water and the coating is removed suddenly and completely over large areas. Failures of this sort are less likely on rough absorbent surfaces where the coating enjoys the advantage of a good key, and the value of mica in these cases is less obvious, but on smooth, non-absorbent surfaces the value of its presence is now widely recognised.

Whilst on this subject of adhesion, it is perhaps worth mentioning that the introduction of mica, without grinding, to an oil-based primer, as a roughening agent, has been found to provide a good key for emulsion paints applied on otherwise smooth metal surfaces. The use of the oil based primer thus modified, with its irregular surface of increased area, beneath the emulsion paint gives the latter a better chance of adhering successfully, especially if the emulsion paint also contains mica.

Failure of emulsion paints either by chalking or cracking when exposed outside is much less likely if water-

ground mica is present. Other defects which occur during application, such as curtaining, or tearing or cissing, are also controlled. Another attractive application of mica is to reduce costs, and this has been found possible, without detriment, in anti-corrosive primers based on red lead, and zinc dust. Primers containing iron oxide and iron oxide/zinc chromate mixtures are improved by the addition of mica.

Substantial amounts of mica can also be introduced, without apparent loss of opacity, into aluminium finishes. For these it is necessary to grind the mica thoroughly into a separate portion of the medium before adding it to the aluminium paint. Because of its chemical inertness mica assists in providing a barrier against acid and alkaline corrosion agents, and its presence is beneficial where such protection of metals and other sensitive surfaces is required.

In preparing metal surfaces prior to painting with liquid anti-rust preparations, it is something of a problem to retain these thin liquids on the vertical surfaces of structures or plant, which are either too large or too heavy to be treated by submersion. The introduction of mica, to a phosphoric acid base, anti-rust solution has been found to convert it to a slurry of suitable consistency, which effectively retains the liquid on the vertical surface. It has also been noticed that the effect is due not only to the increased consistency, but to a natural tendency of the mica flakes themselves to adhere quite tenaciously to the metal. Thus any downward flow of free liquid does not readily dislodge them and their immobility impedes the draining tendency also. Nothing more than simple mixing of the mica is necessary for these liquid preparations for this effect.

# ELECTROSTATIC PAINT SPRAYING

*by* R. TILNEY*

THE application of static electricity to painting has been made in three ways; the first two, chronologically, are the Ransburg No. 1 Process for spraying and the Ransburg Detearing Process for use after dipping or flow-coating. The third and latest development is the Ransburg No. 2 Process in which the use of compressed air for atomising the paint is eliminated and both atomisation and application of the paint are effected by electrical means.

Firstly, the No. 1 process or air atomised spray process, operates by introducing finely atomised particles of the required coating material from a specially modified type of automatic compressed air spray gun, into an electrostatic field where each receives a static charge. Through this same field is passed the work to be coated, the work being loaded on some form of conveyor and through it maintained at earth potential. As a result of the charge on the particles they are attracted to the work at earth potential in accordance with the well-known principle that unlike charges attract. The thickness and uniformity of the coating film are controlled by adjustment of the spray guns and also of the position and method of hanging of the workpieces relative both to the spray guns and to each other.

Next was developed the companion process, electrostatic detearing, applicable to the many types of product which can be satisfactorily coated by immersion in a reservoir of the coating material. The detearing process is also applied to products coated by the more recent development of this type of coating method, "flow coating." After both these methods of coating, an electrostatic field can be used to remove the final drip or tear remaining on the part after draining.

Thirdly, the most recent development, the No. 2 process, is the use of an electrostatic field to atomise the

* *Précis of a paper given by the author to the Institute of Metal Finishing, Organic Section at Birmingham, 9th June. Published by arrangement with the author and the Institute.*

coating material and to deposit it on the workpiece.

The No. 2 process operates on the principle of feeding a controlled uniform supply of coating material to a point at which a highly concentrated electrostatic field is formed, the coating material having already been charged to the same high potential as the electrical source producing the electrostatic field. The electrostatic discharge not only breaks up the coating material into considerably finer particles than can be achieved by other means, but also carries it across the intervening air gap in which the field is created and deposits it on the nearest earthed object.

A source of high voltage, low amperage, unidirectional current is applied to one or more atomising bells which are in the form of bowls having a sharp edge and an axial feed hole by which coating material can be fed to the inside surface of the bell. Mechanical arrangements are provided which ensure that the bells rotate at such a speed that a uniform film of coating material is spread over the inside surface of the bell and is fed at a controlled rate over this surface to the sharp front edge of the bell. The workpieces are passed in front of each bell and generally at right angles to the axis about which the bells turn, and thereby provide the earthed object on which the coating material will be deposited from the bell.

The strong charge applied to the coating material ensures that all of it is deposited on the work, so that the necessary ventilation is limited to that required to remove the solvent vapour. The quantity of air evacuated is therefore very small and has no effective influence on the spray movement. The spray is therefore deposited under the influence of two forces only, firstly the electrostatic force between bell and workpiece and secondly the centrifugal force due to the rotation of the bell. This latter is relatively of much less importance but has the effect of slightly enlarging the pattern provided from a given bell diameter.

The balance between these two forces and the resultant spread is controlled by the condition and nature of the coating material. The viscosity at which the material is sprayed must be accurately controlled if consistent results are to be obtained; the constituents of the paint and solvents have a bearing on whether in practice, the material atomises well (that is, whether it is more or less influenced by electrostatic force). Considerable research remains to be done in this field before the reasons for variation between materials are fully understood.

**Equipment**

The most important part of the specialised equipment required for these processes is, without doubt, the source of high voltage supply since the spray guns, in process No. 1 and the atomising bells, in process No. 2, together with their mountings, are matters of straightforward mechanical design. The electrical equipment for all three processes is the same and consists of a high voltage transformer of about 100 kV output combined with a full wave rectifier either of valve or metallic type. The whole supply is controlled through a spark guard consisting of a balanced electronic circuit whereby the primary current of the transformer is instantaneously cut off if the current in the secondary rises above a predetermined value, in practice about 2 mA. Risk of sparks from the electrodes or atomising bells is therefore eliminated. The negative end of the transformer secondary winding is used as the high voltage side, while the positive end of the winding is earthed.

In addition, the high voltage transformer is interlocked with the ventilation and conveyor systems so that if either ceases to operate the supply is immediately cut off. This, in the No. 2 process, is further interlocked to stop the rotation of the atomising heads and also of the paint supply pumps, while in the No. 1 process, failure of the ventilation cuts off the paint supply to the guns. Similarly, failure of the ventilation of the detearing grid cuts off the supply. All these precautions ensure that no inflammable concentration of solvent vapours can accumulate near to any high voltage discharge points and so reinforce the safety provided by the spark guard device.

Other equipment of a specialised nature can be summarised as follows: **No. 1 Process: Spray guns.** Special air caps and nozzles fitted to standard automatic guns. **Controls.** The atomising air supply to the guns and

the coating material supply pressure are both supplied through specially sensitive control valves.

**Detearing Process.** Specialised electrical control equipment only is required in addition to normal dip-tanks, conveyors, etc.

**No. 2 Process.** The whole of the spraying equipment is of a relatively specialised nature, but presents no features not encountered in normal mechanical equipment except for the necessity of separating earthed parts such as electric motors from those at high voltage by insulators of suitable length to avoid high voltage tracking.

### Wooden Articles

The normal moisture content of wood provides sufficient conductivity to enable a variety of wooden articles to be satisfactorily sprayed, one of the most spectacular examples being that of coloured and clear lacquer on tennis racquets.

## DISCUSSION

Mr. YEATES: Are air drying paints suitable for use in conjunction with electrostatic painting plant?

REPLY: With the Ransburg No. 1 process air drying paints can be used. Up to the present time they have not been successfully applied with the No. 2 process except in a limited number of cases. In the synthetic range of paints a small percentage are also found to be unsuitable for use with the No. 2 process.

Mr. WHITE: Is the process applicable to sharp points and irregular surfaces? Does the "detearing" process strip these sharp points completely?

REPLY: In order to concentrate the electrostatic field in the detearing process, parts are hung so that the tears form at relatively sharp points. With the No. 1 process as with the No. 2, difficulties arise both at sharp edges and sharp points, again owing to the concentration of the electrostatic field. Various methods can be devised to mitigate these difficulties such as earthed screens and special designs of workholders.

Mr. HARRIS: What can go wrong?

REPLY: The plant is remarkably trouble free, however on occasions difficulties have arisen. A selection of typical troubles is as follows:—

(a) Paint coverage in shielded areas.
(b) Blockages in the paint supply lines due to poor maintenance.
(c) Pump failure.
(d) Temperature and viscosity variations. The position is much better with the No. 2 process than the No. 1 due to the higher viscosity range used.

In short, if the plant is maintained properly very little, if any, trouble will be experienced. Spray pattern does not vary to any great extent with viscosity 2 per cent. to 3 per cent. at the most. With certain shielded areas (small orifices, etc.), it may be necessary to institute a "touch in" station using the normal air spray gun.

Mr. MORGANS: Does the remarkable atomisation reduce "cissing."

REPLY: Yes.

Mr. WILLIAMS: In the No. 2 process is the speed of rotation of the head variable with viscosity, etc?

REPLY: Speed of rotation should be just sufficient to spread the paint uniformly over the interior surfaces of the bell but, in practice, standard speeds are used for all spraying conditions.

Mr. LLOYD: What possibility is there of rapid change of colour and contour?

REPLY: In all atomising processes the Ransburg No. 2 process gives optimum results when applied to uniform types of article or groups of articles. By the use of additional equipment relatively rapid paint colour change can be provided for and in this country work is being done to improve the adaptability of the process as compared to that necessary in America. Obviously the process works most efficiently when applied to long runs of the same article with the fewest possible paint changes.

Mr. FREEMAN: How is the process affected by variation in power supply?

REPLY: The process is not affected as a constant voltage transformer is used.

Dr. WERNICK: What facts and figures are available regarding uniformity of film thicknesses as compared with normal spray technique?

How is dust in the atmosphere affected by the electrostatic field?

Is mass production necessary for the

use of the process or is it so economic that the small production would benefit?

Revolving jigs may be of use in the electro-plating industry.

REPLY: The uniformity of the paint film applied by the No. 2 process is illustrated by the way in which it can be seen to be gradually built up. No definite figures of uniformity are available for the No. 1 process but in some cases a variation of from a total film thickness of ·0012 in. to ·0017 in. have been measured. With the No. 2 process applied to flat panels no variations can be detected on a magnetic thickness tester, and in the United States the equipment is adjusted by the use of shim steel test pieces to give absolutely uniform film thickness in order to avoid the application of surplus paint.

Dust is affected by the electrostatic field and depending on its charge will either go to the work or the atomising head, in any case it will eventually be deposited on the work. In this respect No. 2 process has an advantage due to the reduced amount of air required 1-3,000 c. ft./min. compared with 10/30,000 c. ft. per min. required for the normal spray technique or the No. 1 process. It is a relatively simple matter to wash this small quantity of air.

The process will not prove economical unless a certain minimum quantity of paint is being used by existing hand spray methods. It is unlikely that a factory in which only one hand spray operator is employed would find the use of the process satisfactory unless it was for a particular quality requirement. Three spray operators producing uniform components or, of course, the same part, might be considered as a minimum. Frequently parts can be grouped together to provide uniformity although individually they would not be sufficiently uniform for automatic spray painting.

## MANAGEMENT

UNDER the title "A Short Philosophy for Junior Management" the Triplex Safety Glass Co. Ltd. have issued an informative booklet. It is primarily written for members of the firm's supervisory staff, and in particular an effort has been made to include the foreman as the pivotal point in management—which is defined in the booklet as directors, senior staff and foremen.

A real attempt has been made to co-ordinate the activities of the Board, sales, research, joint production and advisory committees, trade unions, hours, factory affairs such as smoking and refreshment breaks, fire and accident prevention, health, medical and personnel services, together with the profit-sharing funds.

Although the book is written around the activities of the Triplex Group organisation, nevertheless it is a useful practical guide on the general question of management.

In conclusion the booklet says:

"A supervisor should be responsive to new ideas and ready to contribute his own. Although many of our activities and policies inevitably become reduced to a formula, it is by no means one of our policies that the scope and the liberty of expression of the individual should thereby be curtailed."

## HIGH VACUUM BY IONIZATION

THE principle of obtaining high vacuum by ionization is not at all new but its practical application is not often met with. Two new pumps using the principle are described in the May issue of *Review of Scientific Instruments* published by the American Institute of Physics. The author of an article in this issue describes the possibilities of such a pump and says that in a simple d.c. gas discharge practically no real pumping action is possible; in such a discharge only clean-up, i.e., electrical adsorption, may be observed. A real pumping action only results if it is possible to get within a tube such a high ion current by special arrangements that the number of ionized gas molecules transported with this current in one direction is greater than the number of gas molecules that will diffuse back in the opposite direction. An electronic high-vacuum pump of real pumping action has been built; it starts pumping at about $10^{-3}$ mm. Hg and gives an ultimate pressure lower than $5 \times 10^{-6}$ mm. Hg.

Another vacuum pump described in the same issue is based on the properties of a magnetically collimated electric discharge. It has a speed in the range 3,000 to 7,000 litres/sec. and a base pressure of the order of $10^{-6}$ mm.

# PERSONAL READER SERVICE SECTION

*Items in the following list of manufacturers' literature are available as a personal service to readers of* INDUSTRIAL FINISHING *by using the reply card below.*

*In addition, the editorial staff of* INDUSTRIAL FINISHING *are always available as an advisory service on questions affecting finishing.*

**Level control,** photo-electric system, for use with storage tanks, hoppers and bunkers. Radiovisor Parent Ltd., 1 Stanhope Street, London, N.W.1. (55)

**Air Compressor,** designed for an oil-free supply of air—based on the yoke and slipper principle. Gives continuous operation up to 350 r.p.m. Explanatory leaflet and diagram. Williams and James (Engineers) Ltd., Chequers Bridge, Gloucester (56)

**Assembly Component Tray,** offers forty separate compartments in swivelled trays of transparent plastic. A portable bench unit described in illustrated leaflet. British Central Electrical Co. Ltd., 6-8 Rosebery Avenue, London, E.C.1. (57)

**Air Compressors,** available as single, twin or four cylinder units; the twin and four cylinder models are available as two-stage compressors. General specification and component details. Williams and James (Engineers) Ltd., Chequers Bridge, Gloucester. (58)

**Centrifugal Pumps,** single-stage, for low and medium pressure duties. The illustrated folder gives a general specification, diagrammatic and sectional drawings, pump-type data, and range of applicatons. Sigmund Pumps Ltd., Terminal House, Grosvenor Gardens, S.W.1. (59)

**Gas Heater,** radiant panel for overhead siting, enamelled or painted finish. Consumption rating details, fixing instructions and maintenance guide are given in the folder. Bratt Colbran Ltd., 10 Mortimer Street, London, W.1. (60)

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**Radiant Heat,** for drying and finishing; gas-fuelled self-contained units which can be built up into ovens or tunnels, and according to requirements. Explanatory leaflet, illustrated. Bratt Colbran Ltd., 10 Mortimer Street, London, W.1. (61)

**Pneumatic Accessories,** relief valves, needle valves, etc., illustrated folder shows variety of components available and their duties. Williams and James (Engineers) Ltd., 4 New Court Street, London, W.C.2. (62)

**Stove Enamelling,** principles, practice and equipment; embodies the theory of heat transfer, methods of heating, fuels, convection and radiant methods—a brochure giving a detailed treatment with accompanying diagrams and illustrations. F. J. Ballard and Co. Ltd., Tipton, Staffs. (63)

**Pneumatic Door Control,** for operation by photocell, manual release for opening and closing, or manual release with time relay. The folder describing the equipment is illustrated, describes the application and operation, and shows the mechanisms in diagram form. Atlas Diesel Co. Ltd., Beresford Avenue, Wembley, Middlesex (64)

**Spraying Equipment,** non-offset for operation by compressed air or electricity. Mounting may be on the ceiling or on the printing press. Instructions for use and maintenance are given in the leaflet with diagram illustrations of the equipments. Atlas Diesel Co. Ltd., Beresford Avenue, Wembley, Middlesex. (65)

**Adhesive Dusters,** with thirty-two separate surfaces for removing fine particles of dust before the finishing coat is applied. Adhesive Dusters Ltd., St. John's Street, Kates Hill, Dudley. (66)

**Flame Hardening,** automatic machines with temperature control equipment, employing the "Milliscope" instrument. The operation of the instrument is described in an illustrated folder.. Surfard Ltd., Abbey House, Victoria Street, London, S.W.1. (67)

**Motorised Control Valves,** for automatic control of gas and air supplies, butterfly type. Descriptive leaflet. Industrial Control Valves Ltd., 72 Gooch Street, Birmingham 5. (68)

**Magnetic Control Valves,** specified for use in conjunction with automatic control equipment for combustion systems on gas-fired furnaces and plant. Industrial Control Valves Ltd., 72 Gooch Street, Birmingham 5. (69)

(*Continued on page* 54)

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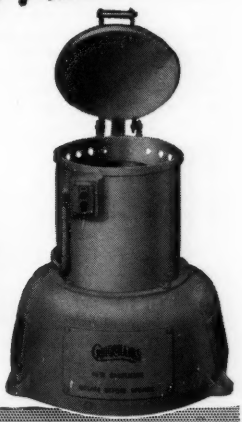

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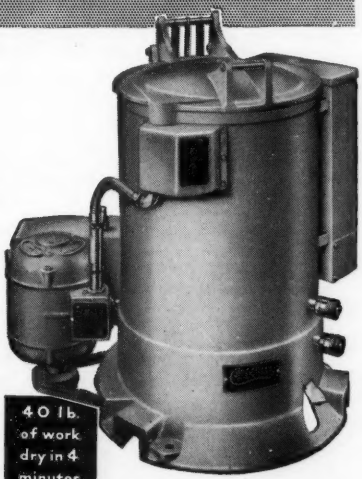

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To obtain literature appearing on these pages, please refer to easy-to-use reply card facing page 52.

**Air-cooled Compressors,** stationary and portable suitable for light and medium duties; automatic, automatic-unloading and hand-operated units are described with measurement and rating details in an illustrated brochure. Atlas Diesel Co. Ltd., Beresford Avenue, Wembley, Middlesex. (70)

**Portable Belt Loader,** tubular framework, air-cooled petrol engine drive, adjustable discharge height. Frederick Parker Ltd., Viaduct Works, Catherine Street, Leicester. (71)

**Industrial Lighting,** units for general and local illumination flameproof types and adjustable lamps, including floodlighting; an illustrated brochure and catalogue with specifications. Metropolitan-Vickers Electrical Co. Ltd., St. Paul's Corner, 1-3 St. Paul's Churchyard, London, E.C.4. (72)

**Radiant Heaters,** overhead types including bowl, panel and wedge; a booklet No. 6A, describes each unit, performance, output and radiation values and application to types of buildings. Bratt Colbran Ltd., 10 Mortimer Street, London, W.1. (73)

**Vacuum Coating Plant,** evaporation and sputtering methods; the processes are described and various types of application charted against plant models. The brochure is illustrated. W. Edwards and Co. (London) Ltd., Worsley Bridge Road, Lower Sydenham, S.E.26. (74)

**High Vacuum Pumps,** rotary, single- and two-stage; each type is illustrated and described with performance chart and curve; diagrams accompany the dimensional table. W. Edwards and Co. (London) Ltd., Worsley Bridge Road, Lower Sydenham, S.E.26. (75)

**Moisture and Mercury Vapour Traps,** for use with rotary pumps and vacuum systems. Descriptive and illustrated folder. W. Edwards and Co. (London) Ltd., Worsley Bridge Road, Lower Sydenham, S.E.26. (76)

**Temperature Controller,** for use with relatively small heat processing plant, furnacing, die casting, extruding, plastics injection, etc. The Industrial Pyrometer Co. Ltd., Gooch Street, Birmingham 5. (77)

**The Pneumerstat,** a control unit combining a bubbler chamber pressure reducing valve and needle valve for compressed air supply, to give a constant flow; industrial or laboratory application. Descriptive brochure and diagrammatically illustrated leaflet. Williams and James (Engineers) Ltd., Gloucester. (78)

**Pressure Reducing Valves,** for starters, exhausters, ram pumps, compressors—gas, water or steam. Folder and leaflet. Williams and James (Engineers) Ltd., Gloucester. (79)

**Auto-shunter,** diesel-engined, making 42 b.h.p., for towing or shunting; ballasted rear wheels. Illustrated folder with specification and diagrams. Epping Engineers Ltd., 75 Lindsey Street, Epping, Essex. (80)

**Two-stage Gas Injector,** incorporating venturii-type choke giving variable air/gas mixing according to demand; supplied in a number of sizes, it is claimed to give high thermal values with consequent fuel economies. The folder is explanatory, detailed and diagrammed. Aeromatic Co. Ltd., Eskdale Road, Cowley Trading Estate, Uxbridge. (81)

**Gas Burner,** of North Thames Gas Board design, applicable particularly to small spaces for use with degreasing vessels, preheating furnaces. Sizes, prices and description are given in a leaflet. Aeromatic Co. Ltd., Eskdale Road, Cowley Trading Estate, Uxbridge. (82)

**Soldering Tools,** low pressure gas equipment, heavy and medium duty, hard or soft soldering. A leaflet. Aeromatic Co. Ltd., Eskdale Road, Cowley Trading Estate, Uxbridge. (83)

**Plating Solution Filters,** gravity and pressure types, portable and stationary; the units are described and illustrated, showing capacity and application. A brochure. W. Canning and Co. Ltd., Great Hampton Street, Birmingham 18. (84)

**Metal Cleaner,** a two-stage process with hot and cold operations, with or without electric current. An illustrated brochure explains the working processes. W. Canning and Co. Ltd., Great Hampton Street, Birmingham 18. (85)

To ensure maximum benefit from this feature, manufacturers are asked to send a specimen of any new literature they think suitable for inclusion.

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**Hard Chrome Deposition,** using "Hardfast" chrome salts, heavy and light deposits; the solution and its application are described in an illustrated leaflet. W. Canning and Co. Ltd., Great Hampton Street, Birmingham 18. (86)

**Bright Nickel Solution,** eliminating buffing between nickel and chrome plating, may be applied to non-ferrous and ferrous metals; advantages are set out in leaflet. W. Canning and Co. Ltd., Great Hampton Street, Birmingham 18. (87)

**Bright Copper Plating,** preparation and uses of the material "Cuprobrite" are given in a leaflet. W. Canning and Co. Ltd., Great Hampton Street, Birmingham 18. (88)

**Ventilation for Works and Factories,** a description of methods and equipment applied to various types of undertakings with a treatment of practical problems. An illustrated booklet. Sturtevant Engineering Co. Ltd., Southern House, Cannon Street, London, E.C.4. (89)

## HOTHERSALL MEMORIAL LECTURE

DR. WILLIAM BLUM, of the Bureau of Standards, Washington, has been invited by the Council to deliver the second Hothersall Memorial Lecture in 1954, to members of the I.M.F., and has accepted. He will thus be the second Hothersall Memorial Medallist.

Dr. Blum, who is at present on an extended lecture tour in Australia, is well known for his many researches in electrodeposition, and as the joint author with Mr. George W. Hogaboom of the classic work "Principles of Electroplating and Electroforming."

The date of the lecture is likely to coincide with that of the International Conference on Electrodeposition and Metal Finishing, which will be held in April, 1954.

## A NEW JENOLITE DEGREASANT

JENOLITE LTD. have recently added added a new preparation to their range of chemical degreasants. It is the Emulsion-type Degreaser, which may be used in the concentrated form supplied or in warm water dilutions up to 1 : 1 to meet individual requirements. Especially effective when applied by agitation with a stiff brush, it may also be applied by the standard immersion process.

Non inflammable, it is an excellent degreasant for all types of metal where no attack can be tolerated. A typical application is on aircraft components or on the underside of motor vehicles, where, in addition to grease, the usual layers of dirt and caked mud are efficiently and speedily removed by the subsequent water rinse, leaving a spotless metal surface.

## USES OF NICKEL

AN article in the June issue of *The Nickel Bulletin* gives the composition, physical and mechanical properties of the alloys of the Hastelloy type. These casting alloys (nickel-molybdenum-iron, nickel-chromium-molybdenum-iron and nickel-silicon) are employed principally in chemical engineering and oil refining for their high corrosion resistance.

Abstracts of recent literature on electrodeposition include a critical survey of substitute finishes which have been tried in the U.S.A. during the period of restricted availability of nickel, a description of a method for plating manganese-base materials, and an explanation of the mechanism of black nickel plating.

*The Nickel Bulletin* is issued free of charge by The Mond Nickel Co. Ltd., Sunderland House, Curzon Street, London, W.1.

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# MANDER'S
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# DECORATIVE PROCESSES

*by* J. H. OUSBEY

THIS is the day of the long-run in productive work, and every endeavour is made to ensure that each process is made as automatic and repetitive as possible in order to keep down costs and obviate bottlenecks in the flow of work. Marking and decorative processes are no exception to these endeavours and, indeed, as potential bottlenecks they may be singled out for special attention in these endeavours.

Manufacturers rightly seek those methods which will ensure an uninterrupted flow of work combined with consistency of appearance. It would appear that there is never much difficulty nowadays in producing goods by the thousand, what is awkward is to make only one or two. Those "one-off" items are apt to be expensive and may at times call for the services of a specialist to whom the production of one or two articles brings no problem, but who could not, by the nature of his work, handle large numbers effectively. *Chacq'un à son métier!* When the one-off problem is encountered with decorative and marking processes, it is as well to consider the specialist, and the way in which he will do the job, this knowledge will be found helpful in planning the finishing work, which will be done before the decoration can be applied.

In a short series of articles on this subject, of which this is the first, we will deal with signwriting work, fine lining and the application and economic aspects of transfers.

**Signwriting**

This title applied to the trade of those who paint letters by hand still persists despite the efforts of the didactic to call them letterers, or letter painters. Such would-be reformers take pains to point out that a sign is an actual physical representation of some object pertaining to the trade outside a building in which the trade is carried on. For example, the earliest signs, notably those outside the premises of such tradesmen as smiths, harness makers and so on, took the form of some recognisable part of the trade engaged in. The harness maker would have a representation of a horse collar, the smith a horseshoe, and the various inns some tangible reminder of their name or trade, all for the benefit of those who could not read. Nowadays if one cannot read, a sign is of little use because the signwriter carries out all manner of painted publicity and only infrequently is he called upon to do pictorial work. As mentioned earlier, the signwriter is usually at his best when executing work in small numbers. Complicated designs and signs when called for in numbers above ten or so are liable to lead to inconsistency and a tailing off in the quality of the work towards the end of the run; this is no doubt caused by the human failing of getting tired both physically and mentally. As is well known to manufacturers of mass-produced articles, there exist today many processes whereby lettering and marking can be done quickly and cheaply, and with a greater degree of consistency than is possible with hand work.

The signwriters' skill in lettering falls under three headings: firstly, setting out accurately; secondly, a knowledge of the correct alphabets; and thirdly, artistic skill with the brushwork. On seeing a signwriter preparing to do his work, the setting out would appear to be most sketchy, but in reality this sketchy and apparently haphazard dabbing at the surface with chalk to mark out the letters is a crystallisation of his years of experience which enable him to merely indicate in chalk where he wishes the letters to go, and even then the position of each letter is only approximate, and the shape of his chalk squiggle happens to be in the shape of the letter just to remind him of its sequence.

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The signwriter carries the alphabets in his head—that is for practical purposes utilising the better-known and more commonly used alphabets. When called on to do something out of the ordinary run of signwriting work, he then has recourse to a printed alphabet. When marking out a signwriter prefers to use soft white chalk wherever possible—that is where the ground on which the lettering is to be done is suitable for chalk and where the white will show up sufficiently well. Chalk has advantages in that it can easily be erased if a mistake is made during setting out, and is to a considerable extent perfectly miscible with the paint with which the work will be done.

The signwriter must work to straight lines in order that the completed lettering presents a level and orderly appearance and his method of securing these straight lines is to use a chalk line. This is a piece of fine cotton or crochet cotton chalked with whiting or even stick chalk, held in position against the measured markings on the work, and the end pulled out and released smartly so that the "snap" line leaves a clear and well defined marking on the work. Some signwriters make a loop in the line in in order that it may be pulled by a second person—or themselves by the aid of their teeth, while others can snap a line quite as well by using just their two hands. Curves and arcs are described by compass or at times when improvisation is called for by the use of the chalk line by making a loop for the chalk and fixing one end, leaving the other end free to describe the arc.

When working on surfaces which are themselves curved, such as motor cycle tanks, the signwriter will mark out using either a flexible strip of celluloid, a plastic rule or even a piece of cardboard, and inscribe the line by sharpening the chalk and using it as one would an ordinary pen or pencil.

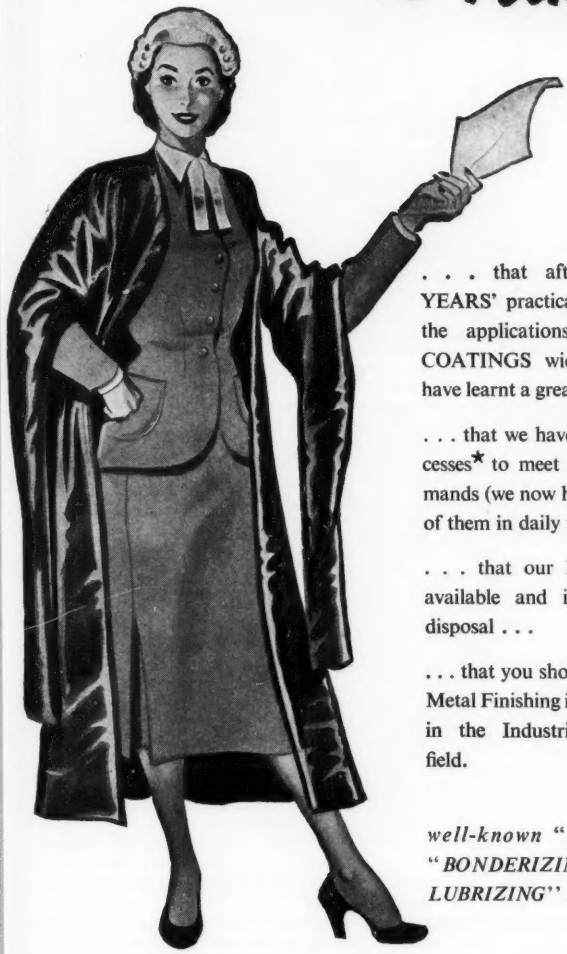
Then follows the approximate positioning of the letters in a very sketchy fashion as mentioned previously. The foregoing is the procedure for normal signwriting work involving several rows of letters and words, each perhaps of different sizes. When the work is to consist of the same sentence, slogan or phrase repeated several times as in the case of a number of signs, each of the same size, the signwriter will adopt a timesaving method which has also the virtue of preserving a considerable measure of accuracy and consistency. This method involves the use of what is known as a "pounce." It consists of describing in detail all the words, designs, etc., to be painted on the signs, on paper and then pricking holes along each pencil line (paying particular attention to corners) so that when the chalk is dusted against the holes the outline design is transferred to the work ready for painting. The pricking of the holes may be done with the point of a pair of dividers or even with a needle, but in the case of large work this is better done with what is known as a "pounce wheel" made specially for the job and which is, of course, a perforator.

The secret of making a good pounce is to use a stiff paper, not too thick and not too thin, to try to prick the holes cleanly and then, when all is complete, to turn the paper over and using a piece of fine glass paper cut away the raw edges of the paper where the pricking has made them stand up. This action makes the holes clean and neat. The signwriter puts the pounce into use by holding or fastening it on to the work and dabbing against it a small muslin bag filled with powdered whiting. All that then remains is to fill in with paint in exactly the same way as if the design had been marked out.

The alphabets used by a signwriter are not always strictly in accordance with those set out by the designers, and to the critical eye of a typographical expert the signwriters alphabets sometimes look quite wrong, but one has to admit that the finished job has a pleasing look when properly executed, even though the weight of the letters in relation to their height may not be in the strict mathematical proportions intended by the designers. The liberties which are taken with Eric Gills' famous Sans Serif alphabet are sometimes considerable! Similarly with the Trajan Roman alphabet originally designed from the lettering on Trajan's Column (a cast of which is in the Victoria and Albert Museum).

This alphabet calls for letters the thickness of which should be 1/11th of their height, and the serifs at the

# It stands to reason...



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**This tradesman's van is a typical example of the sort of job expected of the modern signwriter. The colour scheme is ivory and pale blue and the lettering colours are ivory and dark blue**

*(Acknowledgements: Gould Signs Ltd. and The Exhibition Panel Service.)*

feet of the letters should be a segment of a circle.

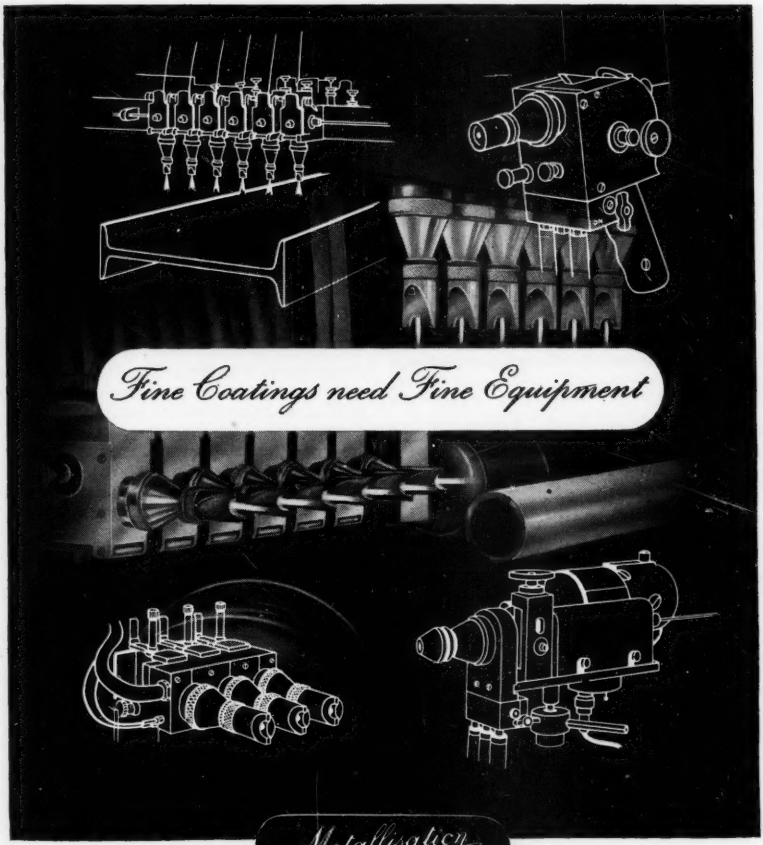
Except for very fine and well paid architectural class of work no-one can really expect a signwriter whose measuring instruments are graded in $\frac{1}{8}$, $\frac{1}{16}$ or 1/10th of an inch, etc., to take pains in ensuring measurements of 1/11th of an inch, but the results, if not exactly Trajan Roman, are certainly pleasing if done by a competent man. As may be expected small lettering calls for greater skill, patience and time than large flowing letters and, therefore, those unaccustomed to the trade charges of the signwriter must be prepared to pay for a sign in small lettering not less but proportionately more than they would pay for a sign with a few large letters.

The foregoing is true if they insist on neat, accurately cornered and scale lettering. With such small lettering if the customer is content with small dumpy lettering known to some signwriters as "sausage style," he will find that his job will work out much more economically and will look quite well.

The signwriter prefers to work with paint which, if it could be obtained, would have achieved the impossible, namely, covering in one coat, remaining wet long enough to enable him to do the most complicated curves with one brushful, not to dry on his brush and yet dry hard enough to be varnished immediately the last letter has been put on. Such has been the writer's experience of what signwriter's ask of paint. As a craft they are not notably well up in paint technology otherwise they would not ask for such high performance with paint. The best paints for signwriters to use are undoubtedly quick-drying flat paints, and they are best made from colours ground in turps so that the user may add gold size for binder and drier, a drop of linseed oil to give length and smoothness of working, and as much or as little pigment to the mixture as he needs to get reasonable opacity.

The qualities of paint for signwriting are certainly unique; they must have sufficient body or thickness to stay on the brush, they must have sufficient smoothness to glide easily over the surface of the work under the pressure of the brush and yet must have sufficient pull or hold on the brush in order that the signwriter does

METAL SPRAYING BY THE WIRE PROCESS GIVES THE GREATEST PROTECTION AGAINST CORROSION

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not lose control. At the same time the paint must cover the ground reasonably well, and as the customer is usually in a hurry it must dry rapidly enough to enable a second coat to be applied fairly soon after the painting of the letters is completed. The ideal letter would be one which, whilst being perfectly solid as regard colour was also as little raised from the surface of the groundwork as possible. Unfortunately the tendency towards speed makes signwriters use quick drying colour and pile it on in an attempt to attain maximum opacity in a short space of time. Such colour is flat, and when dry is only lightly bound and, therefore, if used under arduous conditions and not protected in any way by varnish, will not have much durability, and its thickness from the surface will not add, but in fact, detract from its durable qualities.

Signwriting work is nearly always best if varnished afterwards; one can procure nowadays clear varnishes which do not noticeably affect the tone of a white paint. Where it is not possible to complete the work by varnishing, probably the next most durable method of sign painting is to execute the lettering work in synthetic enamels throughout, using the proper undercoat which dries flat, of course, for the signwriting portion, and using the enamel for the second coating. The signwriters do not find synthetic enamel undercoats as much to their liking under signwriting conditions as the quick turps colours they are accustomed to using. This is because of the quick setting nature of synthetic enamels, the tendency is to set in the bristles of the brush, sometimes whilst the signwriter is working. However, once a signwriter has become used to synthetic enamels for sign work he usually gets to like them because they do possess considerable covering powers and do dry rapidly.

**Gilding**

Probably the most effective, neatest and thinnest (from the point of view of closeness to the surface of the work) lettering work is provided by the use of gold leaf. This is genuine gold beaten extremely thin and applied by the signwriter over a suitable adhesive which he has painted in the form of lettering or a design in the same manner in which he would write a normal sign. The gold leaf itself gives good hiding power and being extremely durable and decorative provides a pleasing finish to any article.

Although gold leaf is extremely expensive, especially nowadays, and not always readily procurable, the finished sign work in gold leaf is not necessarily more expensive than the same sign would be in paint; this is because a completely solid effect is achieved at the end of the second operation in the work, and whilst for work which is to be handled varnishing is necessary, it is not essential for work which is merely exposed to the weather.

The methods used in gilding work are as follows. The entire surface area to be done in gold lettering is dusted with finely powdered whiting applied by a felt or cloth, this is so that the gold will not stick to the paint which forms the ground. The lettering or design is set out in the normal way and the signwriter prepares some oil gold size or a gilding varnish by incorporating a small proportion of pigment such as lemon chrome. The object is not to achieve a solid ground but to enable him to see the letters as he paints them. On dark grounds the signwriter can sometimes dispense with the addition of the pigment to his gold size or varnish, relying on the medium of wiping away the powdered whiting on the surface of the work, leaving the lettering standing out glossy in appearance.

When the lettering work has been completed the gold sign or varnish is allowed to stand until tacky. The degree of tackiness needed for the application of the gold is left to the discretion of the signwriter, although in general it is best if the writing medium is practically dry and the gold pressed on with some force. If the writing medium were merely skin dry there may be a tendency for the gold surface to wrinkle later. Best results are obtained if the writing medium used is a slow one and at one time it used to be the practice for first class gilders to use a slow oil gold size with a twenty-four hour drying period. Nowadays gilders' size may be procured with speeds ranging from ten minutes to two hours.

A factor affecting the speed of the writing medium is the amount of let-

tering to be done. It is irksome for the signwriter to have to stop writing in order to gild some part of the work which has "gone off" and is ready for gold, but by the very nature of the work no matter what the speed of the gold size is, some parts will be ready for gilding before others, therefore it will be noted that an experienced gilder doing lettering work will commence lettering at the bottom line and work upwards, the reason for this being that if he has to gild some of the work before the other is ready, tiny specks of gold cannot fall on to the ungilded portions of the size as would be the case if the top line of lettering was ready for gilding before the lower ones.

An advantage of gilded lettering is that when executed upon a reasonably hard ground any defects in neatness, corners not quite square, etc., may be rectified by careful trimming, using a steel straight edge and a sharp blade such as a razor blade. The writer has often done this trimming and a good tip is to have the work wet so that there is a slight cushion of water between the straight edge and the easily scratched gold.

Normally, when the gilding is completed, the signwriter washes off the loose gold, whiting and marking out lines altogether in one operation with clean water, and then dries the work by dabbing gently with a very clean chamois leather.

## PAINT TRADE CRICKET MATCH

A COMPARATIVELY new development in the paint trade is the organisation of inter-firm cricket. A good example was the match played on Sunday, 19th July, between the team from Robert Kearsley and Co. and the team from Aspinalls (Paints) Ltd.

The occasion was an outstanding success and was enjoyed alike by players and spectators. Arrangements are in hand for a return match which will probably have been played by the time this note appears. The final score was: Robert Kearsley team 150 for 9 wickets, Aspinalls (Paints) Ltd., 67.

In the resin plant at the North British Chemical Co. Ltd., workers and plant are *automatically* protected against explosion hazards by the Honeywell-Brown Protectoglo Combustion Safeguard System. Electronically operated, this device stops instantaneously the flow of gas to a burner in case of flame failure, and gives continuous protection against grounding of the flame electrode. With push-button control, electric ignition and flexibility of design to permit incorporation of temperature or limit controls, if required, it is an invaluable adjunct to gas-fired furnaces, kilns, ovens, lehrs etc. to provide the utmost safety in operation. Details of an installation to suit your particular requirements are available upon request.

**BROWN *ElectroniK* TEMPERATURE CONTROL**

On this same plant, a Brown ElectroniK Circular Chart Controller is incorporated to maintain temperatures at the desired level. Brown ElectroniK "Continuous-Balance" Potentiometers are available for indicating, recording and controlling. Their sensitivity and speed of response ensure the detection and automatic adjustment of the slightest temperature fluctuations. Application and Specification Bulletins are available on request. *British Made Patent Specification 436,098.*

*Photographs by courtesy of the North British Chemical Co. Ltd., Droylsden, Manchester.*

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# Underground Corrosion of Galvanized Steel

A STUDY of underground corrosion of hot-dipped galvanized steel pipe has recently been completed by the American National Bureau of Standards. Results confirm previous N.B.S. work in showing that galvanized steel having 3 oz. of zinc per sq. ft. of exposed surface is highly resistant to corrosion in many soils which are very corrosive to bare steel. Conducted by Irving A. Denison and Melvin Romanoff of the Bureau's corrosion laboratory, the present study was an outgrowth of earlier N.B.S. exposure tests of zinc coatings for underground use.

For the Bureau's study, short lengths of both galvanized and uncoated steel pipe, and also plates of zinc, were buried at fifteen test sites for periods up to thirteen years. Located in widely separated parts of the United States, the test sites represented a wide range of soil properties. After each of five periods of exposure, a set of specimens of each material was removed and returned to the N.B.S. laboratories. After removal of the corrosion products, determinations were made of loss in weight, depth of the deepest pits, and the percentage of area of the galvanized specimens on which coating remained.

Although the nominal weight of the zinc on all the coated specimens was 3 oz. per sq. ft., the actual thickness varied over a wide range. This was shown by a large number of thickness measurements made by a magnetic method, using unexposed samples of pipe from the same lot as the buried specimens. Additional determinations by an electrolytic stripping method showed that a large part of the zinc that was applied to the steel pipe was converted into alloys of zinc and iron.

The zinc coatings provided good protection in most of the soils. In one soil in which bare steel pipe was perforated by corrosion after exposure for only a few years, the coating on the galvanized specimens remained perfectly continuous throughout the entire thirteen year period. In only two of the fifteen soils, both organic, was the zinc coating of negligible protective value.

An interesting finding of the N.B.S. study was the high corrosion resistance that the galvanized specimens continued to show in most of the soils after the outer zinc coating, and even after the zinc-iron alloy layer, had entirely corroded away. This continuing protection is tentatively attributed to an inorganic coating, probably silicious, believed to have been deposited by galvanic action between the outer zinc coating and the underlying steel or alloy layer. This tentative explanation is based in part on unpublished studies which indicate that the zinc-iron alloy layer does not protect steel sacrificially (cathodically), and that the alloy is no more resistant than steel to soil corrosion.

Analysis of the data obtained in the course of the two N.B.S. field studies shows that the minimum weight of zinc coating required to protect steel for a minimum of ten years depends on the nature of the soil environment. In the N.B.S. studies a 2 oz. coating gave sufficient protection in inorganic oxidising soils, but for inorganic moderately reducing soils a 3 oz. coating was required. Highly reducing soils, both organic and inorganic, require coatings heavier than 3 oz. per sq. ft.

In order to obtain maximum life from galvanized pipe in practice, it is necessary either to construct the entire piping system of galvanized pipe or else to electrically insulate the galvanized sections from pipe of other metals. Otherwise, the zinc coating will be removed by galvanic action.

NOTE: *Further details of this N.B.S. investigation are given in "Corrosion of Galvanized Steel in Soils," by Irving A. Denison and Melvin Romanoff.* J. Research N.B.S. **49,** 299 (Nov., 1952) (*N.B.S. Research Paper* 2366; 10 *cents from Superintendent of Documents, Government Printing Office, Washington* 25, *D.C.*)

## NEW GLASS ELECTRODE

### For Use with Alkaline Solutions

THE difficulties experienced in the determination of *p*H of highly alkaline solutions are greatly reduced by a new type of electrode recently introduced by Marconi Instruments Ltd.

Employing a lithium glass membrane in place of a soda-lime type, the new electrode is unresponsive to the sodium ion concentrations present in many high-*p*H solutions. Results obtained with a half-normal sodium hydroxide solution (13·43 *p*H) show, that while errors of the order of 1·5 *p*H are normally encountered using a soda-lime membrane, the new lithium membrane electrode introduces errors not greater than 0·2 *p*H.

The new electrode, Type TM 3888A/8, allows a significant improvement in the accuracy of high-value *p*H determinations and can be considered as complementary to the existing Standard Electrode, Type TM 3888A, which is primarily intended for use up to 9 *p*H.

## B.I.S.R.A. SURVEY

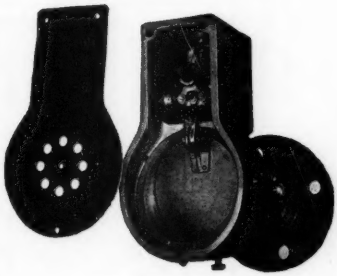
IN the contents of this survey from the British Iron and Steel Research Association are included articles on hot-dip methods of coating steel with aluminium, and how iron zinc alloyed coatings show promise as an alternative to galvanizing. Reference is made to ingot moulds and how savings in mould consumption can be made.

The design of crane controls and crane cabs is discussed, and reference made to a method whereby 95 lb. of pure zinc can be recovered from every hundredweight of dross from galvanizing pots using the lead bath method. Reference is made to sintering and to wire die measurement, pointing out how the close control of drawing die profiles can cut replacement costs.

Other articles include work on flame efficiency, the use of gas turbines for blast furnaces and the continuous thickness measurement of strip. On the question of heating the ingot a reduction of track time between teeming and soaking pits is the likeliest hope of reducing heating costs.

**Factory Equipment Exhibition, 1954.**—The Second National Factory Equipment Exhibition will be held at the Royal Horticultural' Society's Halls, Westminster, from 22nd to 26the March, 1954. The Exhibition will be sponsored by *The Factory Manager and Factory Equipment News.*


# AIR FLOW SWITCH



*DETAILS ON REQUEST*

● **This switch operates as a protective device in all cases where the maintenance of a continuous flow of air is of importance.**

● **A totally enclosed mercury switch ensures absolute reliability even under the most adverse conditions of dust and dirt and also provides complete protection against risks of explosion through sparking contacts in an atmosphere charged with inflammable vapours.**

● **The switch may be used in an ambient temperature up to 350° C. and will operate on a differential as low as 0·1" w.g.**

● **The mechanism functions on air pressure or suction against the restoring force of gravity; no springs of any kind are used.**

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New Defence Specifications for lubricants and paints used by the Services have been drawn up by the Joint Petroleum Products Standardisation Committee and Paints Sub-committee, both of which are sub-committees of the Joint Equipment Standardisation Committee of the Ministry of Defence.

Details of new specifications now laid down are attached. Further specifications will be issued as they become available.

The following is a list of Defence Specifications for Paints and Oils now available and of the C.S. Specifications which they supersede.

| *Defence Specification No.* | *Designation* | *Scope* | *C.S. Specifications Superseded* |
|---|---|---|---|
| DEF/1035 | Paint, Priming, Red Oxide or Iron/Zinc Chrome | A paint required as a primer in the protection of steelwork under both marine and inland outdoor weathering conditions | C.S. 1870, C.S. 2294, C.S. 2307 |
| DEF/1036 | Paint, Priming, Red Oxide or Iron/Zinc Chrome, Stoving | As DEF/1035, stoving variety | C.S. 2274, C.S. 2092 |
| DEF/1037 | Paint, Priming, Red Lead | A paint required as a primer in the protection of heavy structural steelwork, etc. | C.S. 1825 |
| DEF/1038 | Paint, Priming, Red and White Lead | A paint required as a general purpose primer for the protection of joinery. It may also be used as a dual purpose primer on wood and metal assemblies which are painted during or after assembly | C.S. 1186, C.S. 1478 |
| DEF/1039 | Paint, Priming, Zinc Chrome | A paint required as a primer in the protection of light alloys and steel, under both marine and inland outdoor weathering conditions. | C.S. 1454 |
| DEF/1040 | Paint, Priming, for use on Plaster | A paint required as a primer for application to plaster walls, etc. | C.S. 2353, C.S. 2357 |
| DEF/1041 | Paint, Finishing, for the Exterior of Jerricans | A paint required to provide a protective coating to the exterior of jerricans and other small petrol tanks | C.S. 1864 |
| DEF/1042 | (1) Paint, Finishing for the Exterior of Jerricans, Stoving<br>(2) Paint, Concentrated, Finishing, for the Exterior of Jerricans, Stoving, Dipping and Flow-coating | As DEF/1041, stoving variety | C.S. 2688 |
| DEF/1043 | Paint, Finishing, for the Interior of Bulk Petrol Tanks | A paint required to provide a protective coating to the interior surfaces of tanks and containers used for the storage and transfer of petrol in bulk. Suitable for application as a two-coat system to such interior surfaces, and capable of drying in a confined space | C.S. 2350 |



DEFENCE SPECIFICATIONS (*Continued*).

| *Defence Specification No.* | *Designation* | *Scope* | *C.S. Specifications Superseded* |
|---|---|---|---|

| | | | |
|---|---|---|---|
| | | and capable of drying in a confined space | |

DEFENCE SPECIFICATIONS (*Continued*).

| *Defence Specification No.* | *Designation* | *Scope* | *C.S. Specifications Superseded* |
|---|---|---|---|
| DEF/1044 | (1) Paint, Finishing, Vehicles, High Gloss<br>(2) Paint, Finishing, Vehicles (Heat-resisting), High Gloss<br>(3) Paint, Undercoat, for Paint, Finishing, Vehicles | Paints for the painting of Service vehicles where a synthetic coach finish as distinct from a cellulose finish is required | C.S. 2587, C.S. 2590 |
| DEF/1045 | (1) Paint, Finishing, Vehicles, High Gloss, Stoving<br>(2) Paint, Finishing, Vehicles (Heat-resisting), High Gloss, Stoving<br>(3) Paint, Undercoating, Vehicles, Stoving | As DEF/1044, stoving variety | C.S. 2589 |
| DEF/1046 | (1) Paint, Enamel, for Hospitals, Gloss<br>(2) Paint, Undercoat, for Paint, Enamel, Hospital | Paints for the interior protection and decoration of hospitals and other buildings where frequent washing of paint-work is necessary | C.S. 2374, C.S. 2354 |
| DEF/1047 | (1) Paint, Enamel, Finishing, Exterior, Hard Gloss<br>(2) Paint, Undercoat, for Paint, Enamel, Finishing, Hard Gloss | Paints for the interior and exterior protection and decoration of buildings | C.S. 2351, C.S. 2354 |
| DEF/1048 | (1) Paint, Finishing, Ammunition<br>(2) Paint, Priming, for use under Paint, Finishing, Ammunition<br>(3) Paint, Finishing, Ammunition, Lead-free<br>(4) Paint, Priming, for use under Paint, Finishing, Ammunition, Lead-free | Paints required as a system to give an exterior protective finish for steel ammunition. (One coat primer, one coat finish.) | C.S. 2617 |
| DEF/1049 | (1) Paint, Finishing, Ammunition, Stoving<br>(2) Paint, Priming, for use under Paint, Finishing, Ammunition, Stoving<br>(3) Paint, Finishing, Ammunition, Stoving, Lead-free<br>(4) Paint, Priming, Lead-free, for use under Paint, Finishing, Ammunition, Stoving, Lead-free | As DEF/1048, stoving variety | C.S. 2618 |

DEFENCE SPECIFICATIONS (*Continued from page* 69).

| *Defence Specification No.* | *Designation* | *Scope* | *C.S. Specifications Superseded* |
|---|---|---|---|
| DEF/1050 | (1) Paint, Finishing, Ammunition, Single Coat<br>(2) Paint, Finishing, Ammunition, Single Coat, Lead-free | Paint required to provide an exterior protective finish for steel ammunition | C.S. 2619 |
| DEF/1051 | (1) Paint, Finishing, Ammunition, Single Coat, Stoving<br>(2) Paint, Finishing, Ammunition, Single Coat, Stoving, Lead-free | As DEF/1050 stoving variety | C.S. 2620 |
| DEF/1052 | Paint, Finishing, General Service, Gloss | A paint required as an exterior quality air-drying gloss paint for general service use. It will normally be applied as a one-coat finish over the appropriate primer, but it may also be used as a single-coat protective to clean steel | C.S. 2000 |
| DEF/1053 | Standard Methods of Testing Paint, Varnish, Lacquer and Related Products | Standard methods for use in conjunction with DEF specifications for paints | — |
| DEF/2001 | Oil OM–13 | One grade of oil for use under temperate and moderately cold conditions as a buffer oil and hydraulic fluid in gunnery equipment, and in the shock absorbers of certain vehicles having synthetic rubber glands; also for the lubrication, by spray or other means, of fire control instruments such as fuse-keeping and fire control clocks, fire control boxes and tables, and other equipment containing light mechanisms | C.S. 1117 |
| DEF/2002 | Oil OM–21 | One grade of oil suitable for a number of purposes, including use on high-speed shaftings, high-speed machine spindles, small electric motors, and sewing machines, as a light cutting and quenching oil and for flushing the oil systems of piston engines and gearboxes | C.S. 1436 |
| DEF/2101 | Oil OMD–60<br>Oil OMD–110<br>Oil OMD–330 | Three grades of lubricants primarily designed for use in the compression ignition and spark ignition engines of ground equipment operated by the Services | C.S. 2463 |
| DEF/2221 | Grease LG–380 | A grease which is intended for use as a general purpose lubricant (including the lubrication of chassis and of low-speed ball bearings) in cold climates | C.S. 2623 |

## SUBSTITUTE FINISHES, A CRITICAL REVIEW

UNDER the above heading, the American Electroplaters' Society recently published (Proceedings, 39th Convention Number) a 17-page review of the situation in America. Although the review relates primarily to American developments, there is much of interest to British readers. Moreover, the conclusions drawn are quite well applicable to the operation of the various processes in this or other countries.

The author states that substitute finishes must be valued by the following factors: *appearance;* this must be comparable with the finish for which it is substituted; it must also retain its finish for a reasonable time. *Cost and Corrosion Resistance;* these must both approximately equal the former finish or be within a close margin.

The author goes on to describe the short-term equipment programme and to discuss the availability of "know-how" and material. He then lists the finishes in use in order of preference as follows:

*A. Finishes in Extensive Use*

1. Nickel+chromium.
2. Copper+nickel+chromium.
3. Copper+flash nickel+chromium.
4. Copper+chromium.
5. Copper+chromium+clear baked enamel.

*B. Finishes in Moderate Use*

1. Bright zinc.
2. Bright zinc+clear chromate dip.
3. Bright zinc+clear chromate dip+clear baked enamel.
4. Bright zinc+chromium.
5. Bright zinc+chromium+clear baked enamel.
6. White brass (zinc 80 per cent.-copper 20 per cent.).
7. White brass+clear lacquer.
8. White brass+chromium.
9. White brass+chromium+clear baked enamel.
10. Copper+white brass+chromium.

*C. Finishes for Possible Future Use*

1. Copper+Albaloy (copper 55 per cent.-tin 25 per cent.-zinc 20 per cent.).
2. Copper + Albaloy + nickel flash + chromium.
3. Speculum (copper 60 per cent.-tin 40 per cent.)+chromium.
4. Nickelex (copper 90 per cent.-tin 10 per cent.)+chromium.
5. Tin-nickel alloy (tin 65 per cent.-nickel 35 per cent.).
6. Tin-antimony alloy (tin 55 per cent.-antimony 45 per cent.).
7. Chromium.
8. Antimony.
9. Nickel-iron alloy (nickel 70 per cent.-iron 30 per cent.).
10. Composite coatings (nickel+copper +nickel+chromium).

The advantages and limitations of the various coatings are then discussed and the author gives a tabular summary of the usage of protective and decorative finishes in domestic, motor-car, industrial, medical and sanitary applications. The conclusions are summarised by the author as follows:

"At present it is the general opinion that a good substitute has not been found for nickel for outdoor or similar corrosive exposure. Substitute finishes such as copper-chromium, zinc-chromium, and white brass-chromium are being used and found suitable for many purposes. The copper-chromium finish appears to be the most widely used substitute. The addition of baked clear enamels to the substitute or alternate finishes makes them usable for out-of-doors or similar corrosive conditions where nickel is not permissible. The nickel-tin and copper-tin alloys show promise as substitutes for nickel. Additional work must be done to improve the substitutes being used or those contemplated for future use."

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**"Copper in Instrumentation."** — This book, issued by the Copper Development Association, Kendals Hall, Radlett, Herts, deals with the uses of copper and its alloys in certain classes of measuring and control instruments. These are considered under three main headings: pressure- and strain-responsive instruments, electromagnetic instruments, and temperature-responsive instruments. Sections are devoted to the application of copper alloys to diaphragms, capsules, bellows, Bourdon tubes, strain gauges, coils, shunts, etc. The book includes an extensive bibliography.

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**The forty-fifth Annual Autumn Meeting** of the Institute of Metals will be held this year at Southport from Monday 21st September to Friday, 25th September. The Autumn Lecture will be given this year by Dr. Maurice Cook, F.I.M., on Monday 21st September, and the title will be: "The New Metal Titanium." The meeting includes the customary programme of papers, etc., and a number of works visits.

# NAMES IN THE NEWS

## Appointments

Honeywell-Brown Ltd. announce the appointment to the Board of **Mr. V. D. MacLachlan** and **Mr. L. R. Price.** Additionally, Mr. MacLachlan has been appointed general manager of the company.

**Mr. J. R. Gordon** has been elected vice-president and general manager of Canadian operations of The International Nickel Co. of Canada Ltd., succeeding the late Mr. R. L. Beattie in both capacities.

From 4th August, a new technical sales representative commences duty with the Jenolite organisation. He is **Mr. R. E. Gray,** of 250 Cowdray Avenue, Colchester, Essex. Mr. Gray has very wide experience in the application of chemicals for the treatment of metal.

The Lockheed Hydraulic Brake Co. Ltd. announce that **Ivan M. Waller, B.A., M.I.Mech.E.,** has joined the Lockheed organisation to assist, in the first instance, with the development of the Lockheed-Avery flexible pipe and self-sealing couplings division. Ivan Waller was, for many years, a development engineer in the Car Division of the Rolls-Royce Co., and during the last six years was technical director at Small and Parkes Ltd. In 1950 he was awarded the George Stephenson Research prize by the Institute of Mechanical Engineers for his paper on Internal Expanding Brakes for road vehicles.

*Mr. I. M. Waller*

**Mr. W. E. K. Piercy, B.Sc.,** a member of the Publications Committee of the Society of Chemical Industry, has been appointed a director of Albright and Wilson Ltd.

**Mr. R. S. Robinson,** chief chemist at Styrene Copolymers Ltd. for the past five years, has left the company to take up residence in Canada, for reasons of health. Mr. Robinson has played a most important part in the creation and successful development of the products now manufactured by the company. **Mr. W. R. Moon,** sales and technical service manager at Styrene Copolymers since soon after the company was formed, has now taken over from him the position of chief chemist. Mr. Moon

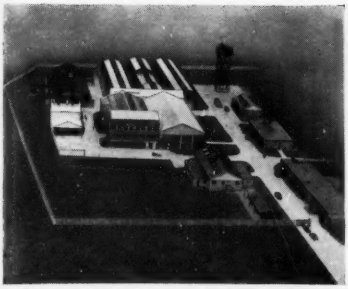
*Mr. W. R. Moon*

*Mr. D. J. I. Davies*

graduated at the Manchester College of Technology. He was with British Titan Products Co. Ltd. before coming to Styrene Copolymers. **Mr. D. J. I. Davies** has joined Styrene Copolymers as sales manager. Mr. Davies is a Jesus College, Oxford, graduate and was formerly chemical engineer with I.C.I. (Billingham), the Mond Nickel Co. Ltd., and L. A. Mitchell and Co. Ltd., Manchester. In the latter firm he was concerned with the design of alkyd resin plants and their sale to paint manufacturers.

**Styrene Copolymers Ltd.** announce that they have appointed two fur- their foreign agents: **Holland and Indonesia:** L. J. Volkers, Sarphatistraat 62, Amsterdam C.; **India:** P. S. Daftary, Abdulla Building, D'Silva Road, Dadar, Bombay 28.

Acting on medical advice, **Mr. J. F. Grundy** has resigned his position as general manager of Robert Kearsley and Co. Ltd., after a term of over 34 years with the company. He joined Robert Kearsley in 1919 as accountant and, in October, 1942, became assistant general manager. Six years later he succeeded M. A. W. J. Talbot who retired from service with the company, as general manager. With effect from 1st August, **Mr. E. P. Frake Walters** has been appointed general manager. Mr. Frake Walters is very well known in most spheres of the paint trade, his connection with the industry dating back to 1919, when he joined the sales staff of R. Gay and Co. After progressing through the offices of district sales manager and sales manager, he became assistant general manager of Robert Ingham Clark and Co., and R. Gay and Co., which post he relinquished to take up this new appointment.



The photograph above shows the new Belfast factory of the Norton Grinding Wheel Co. Ltd., which was opened by the Premier of Northern Ireland, **Viscount Brookborough.** In his address he stated that the factory would employ 300 men when in full production, and would be the most modern plant for making coated abrasives outside the U.S.A.

**Mr. A. D. Kelso,** president of Norton, Behr-Manning, Overseas, Inc., replied for the company and said that the Castlereagh factory was the eleventh enterprise of the Norton, Behr-Manning organisation. It is understood that the factory will be turning out a full range of all the coated abrasive products sold in the U.S.A. by Behr-Manning and not previously available to this country.

**Obituary**

**Mr. James J. Fraser,** managing director of Honeywell-Brown Ltd., died at his home on Friday, July 17th, 1953, aged 51.

Born in Scotland, he graduated from Edinburgh, and in 1928 joined the Minneapolis-Honeywell organisation in Canada, where he became manager of the Montreal office. When in 1936, a decision was taken to form the British company of Honeywell-Brown Ltd., Mr. Fraser was chosen for this work. As managing director since its inception, he has been directly responsible for its growth and development over the years.

*Mr. James Fraser*

His untimely death will be regretted by many—both in industry and among those who met him through the pursuit of his widespread interests.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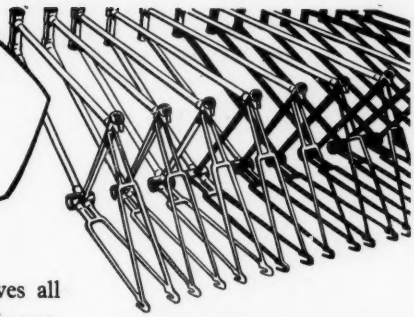

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